A. N. Leontyev

PROBLEMS OF THE DEVELOPMENT OF THE MIND

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I

THE PROBLEM OF THE ORIGIN OF SENSATION

I. The Problem

1

The origin, i.e. the *genesis* proper, of the psyche, and its subsequent evolution, are closely related problems. Our general approach to psychic development is, therefore, directly characterised by how we theoretically resolve the problem of the psyche's origin.

There have been many attempts, of course, to give a fundamental answer to this problem. First and foremost there is the answer that can be briefly designated as in the spirit of 'anthropsychism', and which is associated in the history of philosophical thought with the name of Descartes. Its essence is that the origin of the psyche is linked with the advent of man, and exists only in man. The whole prehistory of the human mind is thus expunged altogether. This view cannot be considered dead today; it is still met, and finds reflection in specific sciences. Some workers still cling to it, holding that the psyche, strictly speaking, is a quality inherent only in man.

Another, opposite answer is given by the doctrine of 'panpsychism', i.e. of the universal mental character of nature. Such views were expounded by certain French materialists like Robinet. Fechner, among others famous in psychology, also held such a view.

Between these two extremes, attributing the existence of mind, on the one hand, only to man, and on the other hand recognising mind as a quality of all matter in general, there are also intermediate views, which are much more common. First of all there is the view that could be called 'biopsychism', the essence of which is that the psyche is a property not of all matter in general but solely of living matter. Such were the views of Hobbes and of many natural

scientists (Claude Bernard, Haeckel, and others). A psychologist who held this view was Wundt.

There is yet another, fourth mode of answering the problem, i.e. that of attributing the psyche not to matter in general, or to all living matter, but solely to those organisms that have a nervous system. This point of view might be called the conception of 'neuropsychism'. It was advanced by Darwin and Herbert Spencer, and has become very common both in contemporary physiology and among psychologists, especially the Spencerians.

Can any one of these four positions be adopted as a standpoint in general to orient us correctly on the problem of the origin of mind?

It is as alien to consistently materialist science to hold that mind is the privilege only of man as to attribute universal spirituality to matter. Our view is that the psyche—mind—is a property of matter that arises only at its highest stages of development, at the level of organic, living matter. Does that mean, however, that *all* living matter has some kind of very simple mind, that the transition from inanimate matter to animate is at the same time a transition to living, sentient matter?

We suggest that this assumption, too, contradicts modern scientific knowledge of the simplest living matter. Mind can only be the product of living matter's subsequent evolution, and of the subsequent evolution of life itself.

Thus we must also reject the contention that the psyche originates together with living matter and that it is inherent in the whole organic world.

There remains the last of the views listed, that the origin of mind is linked with the development of a nervous system in animals. That view, however, also cannot be accepted uncritically, from our point of view. It is unsatisfactory because it arbitrarily supposes a direct link between the development of mind and the development of a nervous system, and ignores the point that, although the organ and the function are inseparably interconnected, their link is not at the same time immobile, singular, and fixed once and for all, so that analogous functions can be performed by different organs.

For example, the function that nerve tissue subsequently began to perform was originally carried out by processes taking place in protoplasm without the involvement of

nerves.[1] It has been found that in sponges (*Stylotella*), which have no nerve elements whatsoever, there are true sphincters, whose action is consequently not regulated by nerve apparatuses (M. Parker). We therefore also cannot accept without further concrete examination (as many contemporary physiologists do) the view that the origin of mind is tied by a direct and unique link with the origin of the nervous system, although there is no doubt about it in the subsequent stages of evolution.

The problem of the origin of the psyche thus cannot be considered resolved, even in its most general form.

This state of affairs naturally led a number of natural scientists to agnostic positions on this issue. In the last quarter of the nineteenth century Emil Du Bois-Reymond, one of the most eminent natural scientists of his time, pointed out, in his address in honour of Leibniz (1880), seven unresolved 'world riddles' for human science.[2] One of these was the problem of the origin of sensation. The President of the Berlin Academy, where Dubois-Reymond delivered his address, rejected several of the 'riddles' outright when summing up the discussion of the unknowability of certain problems for science, but kept three, emphasising their allegedly real inaccessibility to human knowledge. One of these three was the problem of the original rise of sensations, a question that Haeckel called, not by chance, the 'central mystery of psychology'.[3]

There is nothing, understandably, more foreign to consistently materialist science than the views of agnosticism, even if they are limited to just one area of knowledge.

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[1]See: C. M. Child. *The Origin and Development of the Nervous System* (The University of Chicago Press, Chicago, 1921).

[2]See: E. H. Du Bois-Reimond. *Reden*, Vol. 2 (Verlag von Veit und Comp., Leipzig, 1912), p 65. See also: I. F. Ognev. E. Du Bois-Reymond's Speeches and His Scientific Outlook. *Voprosy filosofii i psikhologii*, 1899, *48*: 211. Khvolson, by endorsing Du Bois-Reymond's proposition that the 'riddle of primary sensations' is unresolvable, inevitably came logically to a more general position of 'psychological agnosticism', namely that the problems of psychology are, in general, 'actually alien to natural science' (O. D. Khvolson. *Gegel', Gekkel', Kossut i dvenadtsataya zapoved'* (Hegel, Haeckel, Kossuth, and the Twelfth Commandment), St. Petersburg, 1911.

[3] Ernst Haeckel. *The Riddle of the Universe* (Watts & Co., London, 1931), p 139.

2

The first issue facing investigation of the genesis of the psyche is that of the original, initial form of the psychic. In that regard there are two opposing views. According to one the evolution of mental life begins with the development of a 'hedonic psyche', i.e. with the birth of a primitive, rudimentary self-consciousness. The latter consists in the organism's originally still hazy experience of its own states, experience that is positive in conditions of an abundant diet, growth, and multiplication, and negative in conditions of starvation, partial destruction, and the like. These states, which are the prototype of human experiences of appetite, pleasure, or suffering, allegedly constitute the main basis on which various forms of 'foreseeing' consciousness, i.e. consciousness that apprehends the surrounding world, are later developed.

This view can be justified theoretically only from the standpoint of a psycho-vitalist interpretation of evolution, which posits a special force within the object itself that operated at first as a purely internal stimulus and only later 'armed itself' with external sense organs. We do not consider this view acceptable in modern research that aspires to be rooted in scientific soil, and do not deem it necessary to make a detailed critique of it at this point.

We are compelled, both theoretically and factually, to regard life first and foremost as an interaction between an organism and its environment.

Only through the evolution of this process of external interaction are the organism's internal relations and states developed; internal sensitivity, which is associated, in its biological significance, with functional co-adaptation of organs, can therefore only be secondary and dependent on 'protallaxic' changes (to use Severtsov's term). On the contrary, it is external sensitivity functionally linked with the reciprocal action of the organism and environment that must be regarded as primary.

We shall thus take sensation, which reflects objective external reality, as the elementary form of the psyche, and treat the problem of the origin of the psyche in this concrete form as the problem of the genesis of a 'capacity for sensation' or (what is the same thing) *sensitivity proper*.

What can serve as the criterion of sensitivity, that is

to say, how can we ascertain in general whether a sensation exists, even in its simplest form? The practical criterion is usually *subjective*. When we want to know if a person is experiencing a particular sensation, we can proceed quite simply, without going into complicated arguments about method, by asking him directly and receiving a clear-cut reply. We can, furthermore, check the answer by putting the same question to enough other people under the same conditions. If each of the persons questioned, or most of them, also admit to having the sensation, then clearly there will be no doubt that this phenomenon will really always arise in these conditions. The matter is quite different, however, when we are faced with the question of animal sensations. We have no possibility of appealing to the animal's self-observation; we can know nothing about the subjective world either of the simplest organism or even of highly developed animals. The subjective criterion is consequently totally inapplicable here.

Therefore, when we pose the problem of the criterion of sensitivity (capacity for sensation) as the most elementary form of the psyche, we necessarily must pose the task of searching out a strictly *objective* criterion rather than a subjective one.

But what can serve as an objective criterion of sensitivity? What can indicate to us the presence or absence of a capacity for sensation in a given animal in relation to some particular effect?

Here we must again first consider the state of this question. Yerkes pointed to the existence of two main types of objective criterion of sensitivity available, or supposedly available, to modern zoopsychology.[4] First of all, there were those known as functional criteria, which were criteria, i.e. attributes, of mind residing in the behaviour of animals.

It can be supposed—and this is the first assumption we can make here—that any movement is in general a sign of the presence or absence of sensation. When a dog runs to a whistle it is perfectly natural to assume that it hears the whistle, i.e. that it is sensitive to the corresponding sounds.

Thus, when this question is posed in relation to dogs,

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[4]See: R. M. Yerkes. Animal Psychology and Criteria of the Psychic *J. Phil. Sc. Meth.*, 1905, *2*, 6: 141-149.

things are quite clear at first glance; when we transfer it, however, to animals at a lower level of evolution, and pose it in general form, we at once discover that movement no longer means the existence of animal sensation. Mobility is inherent in every animal; if we took it generally as a sign of sensitivity we would have to say that there is sensation as a psychological phenomenon wherever we find phenomena of life, and consequently movement, but that directly contradicts the thesis (incontestable for us) that the psyche, even in its simplest form, is not a property of all organic matter but is inherent only in its higher forms. We can, however, take approach to movement itself in a more differentiated way and inquire whether certain forms of it only, and not all movement, may not be the indicator of sensitivity. A limitation like that also does not solve the problem, since we know that even very clearly felt effects may not, in general, be associated with overt external movement.

Movement consequently cannot serve as a criterion of sensitivity.

It is possible, furthermore, to consider the function of movements rather than their form the sign of sensitivity. Such, for example, are the attempts of certain members of the biological trend in psychology to consider an organism's capacity for defensive movements, or the link between its movement and its antecedent states and its experience, as a sign of sensation. The first of these suggestions is untenable because movements of a defensive character cannot be counterposed to other movements that are an expression of the simplest reactivity. It is a property of all living matter to respond somehow to effects, not only to those favourable to the living body but also, it goes without saying, to unfavourable ones. When an amoeba, for instance, extends a pseudopod in response to the spread of acid in the water around it, that movement is undoubtedly protective, but it is hardly any more evidence of the amoeba's capacity for sensation than the opposite movement of thrusting out a pseudopod to engulf food matter, or the active movements of 'pursuing' prey, so vividly described in protozoa by Jennings.

We are thus unable to single out any special functions that could differentiate movements associated with sensation from those not so associated.

The fact of the dependence of an organism's reactions on its general state and preceding influences is equally not a specific sign of sensation. Some workers (Bohn and others), suggest that if movement is associated with an animal's *experience*, i.e. if the animal displays a rudimentary memory in its movements, then these movements are associated with sensitivity. This hypothesis, however, also comes up against a quite insuperable difficulty: capacity to change and to alter a reaction as a result of antecedent influences can also be conclusively established wherever phenomena of life in general can be established, because any living and viable body has a property that we call mnemic function in the broad sense that Hering and Semon used this concept.

Some speak of a mnemic function not only in relation to living matter in the proper meaning of the word but also in regard to the kind of non-living structures that are only *similar* physico-chemically to living protein, but are not identical with it, i.e. in relation to inanimate colloids. The mnemic function of living matter is, of course, a qualitatively different property from the 'mneme' of colloids, but that gives us all the more reason to say that the property that is expressed in accordance with a living organism's reaction to past influences experienced by it is observed everywhere in life conditions. That also means that this last moment cannot serve as a criterion of sensitivity.

The reason why it is impossible to infer sensation from animals' motor functions is that we lack objective grounds for distinguishing *irritability* or *excitability* on the one hand, which is usually defined as the general property of all living bodies to enter into a state of activity through the effect of external influences, from *sensitivity* on the other hand, a property which, although it is a certain form of excitability, is, however, a qualitatively unique form. In fact, whenever we try to infer sensation from movement we come right up against the impossibility of establishing whether, in a given case, we are dealing with sensitivity or with an expression of the simple excitability that is inherent in all living matter.

Quite the same difficulty arises when we move from functional criteria (as Yerkes called them) to structural ones, i.e. when we try to infer the existence of sensation not from a function but from an animal's anatomical organisation. The morphological criterion is even less reliable. The reason

for that is, as we have already said, that organs and functions constitute a unity yet are, however, by no means related to each other, either in a fixed or in an unambiguous way.[5] Similar functions can be performed at different stages of biological evolution by structurally different organs or apparatus, and vice versa. Thus, for example, any movement specific to their species is performed in higher animals by their neuromuscular system. Can we, however, say on that basis that movement exists only where there is a neuromuscular system? and on the contrary that where there is no such system there is no movement? Of course we cannot, because movements can also be performed without a neuromuscular apparatus. Such, for example, are the movements of plants like turgescence (swelling) motions achieved by a rapidly rising fluid pressure that squeezes the plasma membrane against the cell wall and so stretches the latter. These movements can be very intense, since the pressure in plant cells sometimes reaches a value of several atmospheres (Hans Molisch). They can also sometimes be very rapid. We know, for example, that the leaves of Venus's fly-trap (*Dionaea muscipula*) shut instantly when touched by an insect. But just as the absence of a neuromuscular apparatus cannot serve as a sign of the impossibility of movement, so, too, the absence of a differentiated sensory apparatus cannot serve as a sign that rudimentary sensation is impossible, although sensations are always associated with definite sense organs in higher animals.

In mimosa the effect of an injury to one of the terminal pair of pinnae of its large pinnate leaf is known to be transmitted down the vascular bundles along the central stem, so that a wave of excitation runs through the leaf causing all the pairs of pinnae to fold up, one after the other.

Is the apparatus of the transformation of mechanical excitation here, as a result of which neighbouring pinnae shrivel successively, an organ transmitting sensation? We cannot, understandably, answer that question, because to do so we would have to know what differentiates apparatus of sensitivity proper from others, e.g. transformers of external influences. And for that we would have to know how to distinguish between the *processes* of irritability themselves and those of sensitivity.

[5] See: Anton Dohrn. *Der Ursprung der Wirbeltiere und das Prinzip des Funktionswechsels* (Berlin, 1875).

When we pass to structural criteria, incidentally, i.e. to analysis of the anatomical substratum of functions, it would seem at first glance that we then have the opportunity to utilise comparative anatomical study and can proceed not only from external comparison of organs but also from the findings of investigation of their actual genetic succession. Perhaps study of the succession of organs in evolution will help us associate organs whose functions are well known to us in higher animals with organs that are quite dissimilar to them but genetically linked with them, and so enable us to establish the commonness of their functions? If we had such a possibility the solution to the problem of the genesis of sensitivity would simply be to proceed along that path, i.e. to study meticulously how an organ evolved and was converted into one with a different structure but performing an analogous function. Here, however, we also come up against an insuperable difficulty, namely that the evolution of organs is governed by the principle of non-coincidence of their origin on the one hand and of their function on the other.

Modern comparative anatomy distinguishes two very important concepts—those of homology and analogy.

> In analogy and homology (Dogel says) we have two *equivalent* though heterogeneous categories of phenomena. Homologues express the capacity of organisms to adapt themselves to different conditions, starting with the same material (identical organs), through natural selection in the course of evolution, and to achieve a different effect: from the fins of fish have evolved organs for swimming, walking, flying, and copulating, etc. In analogues organisms' capacity to come to the same result starting with different basic material, and to create functionally and structurally similar formations that have nothing phylogenetically in common, such as the eyes of vertebrates, cephalopods, and insects, makes itself felt.[6]

The path of direct comparative morphological research is thus also closed for answering the problem of the origin of sensation, because organs with a common origin may, however, be associated with different functions. There may be homologies between them, but there may also be no analogies; this discrepancy, moreover, naturally becomes sharper

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[6] V. A. Dogel. *Sravnitel'naya anatomiya bezpozvonochnykh* (Comparative Anatomy of Invertebrates), Part I (Uchpedgiz, Leningrad, 1938), p 9.

the longer the interval of evolution we take and the lower the evolutionary stages we descend to. While we can, therefore, quite confidently orient ourselves on the functions of organs at higher stages of biological evolution, this becomes less reliable the further we move away from the higher animals. That is also a basic difficulty in distinguishing organs of sensitivity from organs of excitability.

We thus come back once again to the problem of sensitivity and excitability (irritability), but it now faces us in a different form, viz., how to distinguish organs of sensation from organs that are irritable but nevertheless not organs of sensation?

The impossibility of distinguishing objectively between processes of sensitivity and irritability led nineteenth-century physiology to ignore the distinction altogether. The two terms 'sensitivity' and 'irritability' were therefore often used as synonyms. At the dawn of its development physiology did, it is true, distinguish between the two concepts, that of sensitivity on the one hand and that of irritability on the other hand (von Haller's *sensibilitas* and *irritabilitas*).

The need to distinguish between them has again become an important issue for physiology in our day, which is understandable; modern physiologists are drawing nearer and nearer to study of the physiological processes that are directly connected with one of the higher properties of matter, i.e. with mind. It is no accident that we again find the idea in Orbeli of a need to distinguish between these two concepts, 'sensitivity' and 'irritability'.

> I shall try and use the concept 'sensitivity' ... only in those cases when we can say with certainty that the excitation of a particular receptor and its corresponding higher formations is accompanied with the onset of a definite subjective sensation.
>
> ...In all other cases, when there is no certainty that the excitation in question is accompanied with some sort of subjective sensation, or cannot be, we shall speak of a phenomenon of irritability and excitability.[7]

The criterion that Orbeli used to distinguish between irritability and sensitivity is still purely subjective. While a subjective criterion of sensitivity can be used for purposes

[7] L. A. Orbeli. *Lektsii po fiziologii nervnoi sistemy* (Lectures on the Physiology of the Nervous System), 3rd edition (Moscow-Leningrad, 1938), p 32.

of research on man, and is useful in practice, it is, to put it bluntly, non-existent for animals. According to Ziegler, an animal psychologist, the concept of sensation is entirely devoid of value in zoopsychology. From the standpoint of a purely subjective interpretation of sensitivity that is quite correct, of course, but it is only one step from there to the fundamental conclusions that were drawn at the end of the nineteenth century in a number of pronouncements by zoopsychologists (Bethe, Beer, and Uexküll), who quite clearly and unequivocally advanced the following paradoxical thesis: that scientific zoopsychology is in no way a science of the psyche of animals and can never become one.[8]

The problem of the genesis of sensations, i.e. of sensitivity as the elementary form of the psyche, is thus quite the same in concrete investigations as it is in general theoretical views. The only difference is that in the one case we have a *principled* affirmation of the standpoint of agnosticism in the problem of the origin of mind and in the other case an *actual* position of agnosticism expressed in a rejection of real attempts to penetrate by objective methods (and that is the sole possibility as regards animals) into the range of phenomena that we call psychic and which are formed in their elementary form as phenomena of sensitivity. It is this lack of an *objective* and at the same time *direct* criterion of animals' sensitivity, of course, that has led to most theorists in psychology denying outright that the transition from a capacity for irritability to one for sensitivity is a problem for experimental investigation, on the pseudogrounds that excitability and sensitivity are allegedly concepts relating to two fundamentally different spheres of reality: the one—irritability or excitability, to the material facts of organic nature, the other—sensation or sensitivity, to the world of phenomena which are understood either as an expression of a special, spiritual principle or as purely subjective phenomena accompanied with various organic processes and hence exempt from scientific consideration.

In its general form this idea has been shared by almost all post-Cartesian psychology. Even those trends that are

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[8] See: T. Beer, A. Bethe, und J. von Uexküll. Vorschläge zu einer objektivierenden Nomenklatur in der Physiologie des Nervensystems. *Biologisches Centralblatt*, 1899, *19*, 13: 517-521.

opposed to one another in their philosophical leanings take their stand on the same initial premise of a metaphysical opposing of subjective mental phenomena and the objective content of material vital processes. In some instances this position is expressed in a direct divorce of mind from matter or, on the contrary, in attempts to reduce mental processes mechanically to physiological ones, and in other cases to recognition of a pre-ordained 'parallelism' or a purely idealistically understood 'interaction' somehow existing between them. Despite the quite obvious hopelessness of this position, especially as regards specific study of the psyche, bourgeois psychology sticks firmly to it. It has also injected this subjective stand into the problem of the genesis of mind, but here its theoretical untenability reveals itself very clearly.

3

The hopeless situation of the problem of the origin of sensation that has arisen in bourgeois psychology despite the immense factual material gathered on animal behaviour obliges us from the start to counterpose a fundamentally different approach, which follows from a fundamentally different conception of the psyche, to its general theoretical positions.

Mind is a property of living, highly organised material bodies that consists in their ability to reflect through their states the reality around them, which exists independently of them. That is the most general, materialist definition of mind. Psychic phenomena, i.e. sensations, presentations, concepts, are more or less precise, profound reflections, images, pictures of reality. They are consequently secondary to the reality they reflect, which is, on the contrary, primary and determinant.

This general theoretical, philosophical proposition is basic for materialist psychology. Therefore any attempt to represent the psychic as if linked with matter, yet at the same time belonging to a special spiritual basis, is a departure from scientific positions. We cannot confine ourselves merely to acknowledging that our notions, concepts, and ideas and the objective reality which is reflected in them, are not the same. That is to stress only one aspect of the matter. For psychology, however, it is especially important also

to stress another aspect, namely that any reflection of the objective world in psychic phenomena is nothing other than a function of a material, corporeal subject which itself is a particle of that world, in other words, that the essence of the psychic lies in the world of objective relations and not outside it. The task of scientific psychology is above all to find that way of concretely studying these subjective phenomena that would, figuratively speaking, penetrate beneath their surface and lay bare their objective relations.

This line of inquiry is clearly not only a matter of abstract interest, but is one of the actual direction, content, and outcome of any specific psychological investigation.

An elementary naive view of mind reveals the profoundly unique nature of psychic phenomena that sharply distinguishes them from other, objective phenomena of reality. From that standpoint, our activity seems to occur as it were on two primordially different, opposite planes: (a) on a subjective ideal plane (i. e. the activity of our consciousness, thought); and (b) on an objective plane—the plane of phenomena of the material world, i. e. our external material activity, the movements of our body, and those internal processes which are their physiological basis. Everyone is well aware of these various subjective phenomena from his own inner experience. By employing self-observation we can describe them quite accurately, although it is not always equally easy to do so. A simple description of phenomena, however, still does not give us scientific knowledge. We need somehow to know how to uncover them, i. e. to discover their essence, and to pass from what at first seems to be the object of our study to what it really is. Such, too, is the task of all scientific knowledge and it is the task facing scientific psychology.

How, in fact, and in what direction, should an investigation move in order to penetrate behind the semblance of the 'pure subjectivity' of mental phenomena and yet, at the same time, not to lose the object of study—mind itself? Ever since psychology became a science this issue has continually arisen at each new, key stage in its development. Each psychological trend has tried to deal with it in its own way. The multiformity and complexity of these attempts should not, all the same, be exaggerated. They are very limited, despite the show of terms in which they are clothed.

First of all there is the attempt to examine our psychic

world, i. e. the world of our ideas, senses, and reflections, by looking inside this world itself for the laws that express its essence. Can the findings of observations of variable, unclear subjective psychic phenomena lead us, perhaps, through their careful rational elaboration to understanding of the laws and principles governing the 'little world' of our consciousness in the same way that observation of twinkling, sometimes cloud-hidden stars led mankind to discover the laws governing the motion of the 'big world', the world of the Universe?[9]

This idea of classical rational psychology has never, of course, been realised, and it never will be. The world of the phenomena of consciousness is not at all like that of the planets. Consciousness cannot be examined in its self-contained being, because there are no independent relations within it. When we speak of 'mental movements' or 'spiritual forces', these are no more than simple metaphors. The phenomena of consciousness are always related to something and reflect something in themselves. For that reason any independent 'physics' of the phenomena of consciousness, any 'mathematics of ideas', any 'geometry' or pure 'logic of spirit' is impossible.

Simple observation already shows us the dependence of the phenomena of our consciousness on the external material reality that is reflected in them.

If, however, starting from this perfectly obvious fact, we try to look for explanations of their existence in the reality itself that is reflected, abstracted from the subject, we prove to be completely outside the object of our study from the very first step. The reality, reflected by our consciousness, is a world whose relations and connections are not in any way psychological. I can study a thing in itself, or the conscious image or idea that I experience, as deeply and from as many angles as I please, but I shall not be able thereby, all the same, to find in it the laws of the consciousness that reflects it.

We can try to discover the phenomena of consciousness by taking another path. We can move from their surface, not to the external world but, on the contrary, inward in the direct, literal sense, i.e. to the brain and the physiological

[9] See: E. Spektorsky. Physicism and Freedom in Seventeenth Century Rational Psychology. *Voprosy filosofii i psikhologii* (Moscow, 1915), Book 130.

processes taking place in it. In this case, too, however, we are threatened with loss of the object of our study. The phenomena and processes which we discover in the brain and other organs of our body are physiological and not psychological ones. The psyche is always linked with them and does not exist apart from them. Yet can we see in them the *essence* of the psychic?

> One day we shall certainly 'reduce' thought experimentally to molecular and chemical motions in the brain; but does that exhaust the essence of thought?[10]

Consciousness, thinking, and mind are not reducible in general to processes taking place in the brain, and cannot be deduced directly from them.

With this approach we thus find independent, external reality on one side of mental phenomena, and the brain and the nervous, physiological processes that take place in it on the other side, i.e. we find in both cases phenomena that are not psychic. The last may seem to lie on a purely mathematical plane devoid of any 'depth' whatsoever. It is thus as though study of these phenomena can only move over their surface and as though any attempt to penetrate behind them leads us in general outside the mind (psyche).

This feature of psychic phenomena—one that is of course imaginary—provided grounds for advancing the idealist thesis that mind, as Lotz put it, is what it gives itself out to be, in other words, that the phenomena and essence coincide in the mind, that objective causal understanding of it is consequently impossible, and that psychology is therefore forever doomed to remain a collection of purely descriptive data on man's direct contemplation of his own mental world.

But does the error leading to avowal of the scientific unknowability of mind lie, perhaps, in the attempt to consider mental phenomena in isolation from the external world and from the organism's physiological processes? In order to penetrate to the psyche's causal relationships and laws is it perhaps sufficient simply to consider both these relations simultaneously? That was the path of experimental physiological psychology in the nineteenth century.

Its spokesmen considered both a psychology consisting of

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[10] Frederick Engels. *Dialectics of Nature* (Progress Publishers, Moscow, 1972), p 248.

general arguments about mental phenomena and one based entirely on the data of self-observation equally unrewarding. They started from the following idea: in order to subordinate psychology to science, it was enough simply to acknowledge the empirical fact of a link between the phenomena of consciousness and physiological processes and the conditionality of both in external influences, and then to proceed to their joint study by the experimental method.[11]

One very simple circumstance, however, raised an insuperable obstacle to this line of inquiry, which was that, when a test gives us, on the one hand, a rigorously causal series of objective physiological phenomena and, on the other, a series of phenomena of consciousness, we are unable to find the transition from one to the other. All we have a right to say, in sticking to experimental material and not crudely contradicting the scientific interpretation of causality, is that they move in parallel. If we set out from the subjective phenomena, we find that analysis of the corresponding physiological processes, although relevant to the very important matter of their anatomical-physiological substratum, cannot essentially add anything to the data of self-observation, and cannot enhance their value. If, conversely, we start from an analysis of objective physiological processes in their connections with external influences, we find that there is no need at all, for a scientific explanation of them, to bring in the subjective facts of consciousness because, in the well-known saying, consciousness is no more able to influence their natural course than a walker's shadow affects his footsteps.[12]

Some psychologists drew the very radical conclusion from this that it was necessary to dispense with the study of subjective phenomena altogether, and regard them as outside the province of psychology.

[11] See: W. Wundt. Über psychologische Methoden. *Philosophische Studien*. Vol. I (Leipzig, 1883); Th. Ribot. La psychologie allemande contemporaine (Alcan, Paris, 1896).

[12] It was not by chance that this idea, which expresses the theoretical crisis of psychology at the end of the nineteenth century, was put by Vvedensky at the basis of his 'law of the lack of objective indicators of mental life', the purport of which consisted in asserting the objective, empirical incognisability of mind (A. I. Vvedensky. *O predelakh i priznakakh odushevleniya* (On the Limits and Indications of Mental Life), St. Petersburg, 1892; see also N. Ya. Grot's Protest against This 'Law' in *Voprosy filosofii i psikhologii*, 1893, Book 16, pp 117-118).

For idealist psychologists this served as an extra excuse for defending descriptive psychology and resurrecting rational psychology in its worst, 'modernised' forms. So the task of disclosing the essence of mind still remained beyond the pale of positive scientific investigation.

It would, of course, be wrong to deny the positive part played by traditional psychology in developing concrete psychological knowledge, that is evidenced above all by the factual material it accumulated. It would be just as wrong to represent the history of the development of theoretical psychology as simply that of empty delusions that can teach us nothing. It is, of course, not only a history of delusions but also a history of persistent search for the answer to the fundamental and greatest question in psychology, viz., what is its real subject matter.

It is impossible, however, to close one's eyes to the fact that psychological science, restricted by the framework of bourgeois philosophy, has never risen above the level of a purely metaphysical opposing of subjective psychic phenomena to the phenomena of the external world, and could therefore never penetrate their real essence, and that both here and in psychology, the clumsy cart-horse of ordinary bourgeois thought stops every time, perplexed, at the ditch that divides essence from appearance, and cause from effect.

In reality the opposition between the subjective and objective is not absolute and *a priori*. Development generates their opposition, but mutual transitions are preserved between them throughout the course of development, eliminating their 'one-sidedness'. We cannot, consequently, limit ourselves to a purely external comparison of subjective and objective data, but must discover and study this profound and concrete process whereby the objective is transformed into the subjective.

4

What is the real process that links the two poles of the opposition of the objective and subjective, and thus determines whether surrounding teality is reflected in the mind of the subject we are testing—human or animal—and what is the exact form that this reflection takes? *What*, in other words, creates the *necessity* of the mental reflection of objective re-

ality? The answer to that is given in Lenin's proposition that 'man could never have adapted himself biologically to the environment if his sensations had not given him an *objectively correct* idea of it'.[13]

The need for sensations, and moreover sensations that give a correct reflection of reality, consequently, lies in the conditions and requirements of life itself, i.e. in those processes that actually link man with the reality around him. Both the form in which the corresponding object of reality is reflected in consciousness, and precisely how it is reflected depend equally on what the process is that links man with that reality, on what his real life is, in other words on what his being is.

These propositions, whose correctness is obvious when we have to do with human consciousness, are no less valid as well (as we shall see) when we are concerned with the processes of the reflection of reality in their rudimentary forms in animals.

Thus, in order to reveal the necessity of the psyche's origin, and its further development and change, we must start not from the features of the subject's organisation taken by itself, and not from the reality, taken by itself, i.e. in isolation from the subject, that surrounds him, but from an analysis of the process that really links them together.

And that process is nothing other than the process of life. We have to start, consequently, with analysis of life itself.

The validity of this approach to study of the mind's origin and its evolution can also be seen in another way.

We regard mind as a property of matter. But any property reveals itself in a definite form of the motion of matter, in a definite form of interaction. Study of any property is also study of the appropriate reciprocal action.

> *Reciprocal action* is the first thing that we encounter when we consider matter in motion... Thus natural science confirms ... that reciprocal action is the true *cause finalis* of things. We cannot go back further than to knowledge of this reciprocal action, for the very reason that there is nothing behind to know.[14]

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[13] V. I. Lenin. *Materialism and Empirio-Criticism* (Progress Publishers, Moscow, 1967) p 166.

[14] Frederick Engels. *Op. cit.*, pp 231-232.

Is this issue resolved in the same way in reference to mind? Or is the psyche perhaps something exceptional, a 'supranatural' property, which can never show its real face and cannot be discovered in any real interaction, as idealist psychologists think? Marxism gives a perfectly clear answer to this question: 'What Hegel calls reciprocal action is the *organic body* which, therefore, also forms the transition to consciousness,' Engels noted further.[15]

What, in that case, is the process of reciprocal action in which the highest property of matter that we call mind or the psyche is revealed? It is a definite form of the vital processes. If there had been no transition of animals to more complex forms of life, there would not have been mind, because *it is in fact a product of life's increasing complexity*. Conversely, if the psyche had not arisen at a certain stage in the evolution of matter, those complex vital processes would have been impossible whose *sine qua non* is a capacity for psychic reflection by the subject of the material reality around him.

Thus the main conclusion we have reached is that, in order to resolve the issue of the origin of mind, we must begin with an analysis of the conditions and the process of interaction that engender it. But these conditions can only be the conditions of life, and this process—only the material life process itself.

Mind arises at a certain stage of the evolution of life not by chance, but of necessity, i.e. naturally. But in what does the necessity of its origin consist? Clearly, if mind is not simply a purely subjective phenomenon, and not just an 'epiphenomenon' of objective processes, but a property that has real importance in life, the necessity of its origin is governed by the evolution of life itself. More complex conditions of life require an organism to have the capacity to *reflect* objective reality in the form of the simplest sensations. The psyche is not simply 'added' to the vital functions of organisms, but arises in the course of their development and provides the basis for a qualitatively new, higher form of life—life linked with mind, with a capacity to reflect reality.

This implies that in order to disclose the transition from living matter that still has no psyche to living matter that

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[15] *Ibid.*, p 309.

has one, we have to proceed not from internal subjective states by themselves, separated from the subject's vital activity, or from behaviour taken in isolation from mind, or merely as that through which mental states and processes are studied, but from the real unity of the subject's mind and activity, and to study their internal reciprocal connections and transformations.

II. Hypothesis

1

We have seen that from metaphysical positions the problem of the genesis of mind cannot be transplanted into the soil of specific research. Psychology has so far not had any satisfactory *direct* and *objective* criterion of the psyche on which it could base its judgments. We have had, therefore, to reject the old psychology's traditional subjective approach to this problem and to pose it as one of the transition from the simplest forms of life, which are not necessarily associated with phenomena of sensitivity, to the more complex forms that are necessarily, on the contrary, connected with sensitivity, with a capacity for sensation, i.e. the simplest embryonic psyche. It is also our object to examine these forms of life and the transition existing between them.

Life is a process of special reciprocal action between bodies organised in a special way. What, however, distinguishes the processes of reciprocal action unique to living matter from those of non-living matter?

There is a view of life that every body is a complex physio-chemical machine put in action by energy coming from outside. This equating of the living organism with a machine is, however, profoundly false, and contradicts the basic facts characterising life.

Any machine working on thermal, electrical, or chemical energy is a simple transformer of this energy, which means that for it to operate, it must receive some quantity of energy from outside and partly convert it into external work and free thermal energy, and partly expend it in the wear of its own parts. With the exception of wear and tear, the machine itself, and the material from which it is made, undergo no changes in connection with its work. A machine's wear

itself, moreover, is only an external consequence of its work and is not, of course, a necessary essential condition of the processes that takes place in it.

We have a quite different situation in the case of the work of a living organism, which is only possible given permanent changes in the organism itself. When an organism responds to an external effect by motion, the work done by it comes not from the energy of the particular effect, but always from the energy of a partial breakdown or alteration of the structure of its component material particles, associated with a fall in its energy potential, i.e. from the energy of processes of dissimilation. An organism or organic tissue can therefore respond to an external influence only when it is an energised structure. As the result of the reaction made the energy potential of the corresponding tissue notably falls until finally the now exhausted tissue ceases to respond at all to the external influence. The matter broken down in connection with the organism's work is the material of the organism itself. This means that energy, or energy-liberating matter, coming in from outside, which can be utilised by the organism, is not converted into work directly, but is first *assimilated* by it, i.e. is converted by the activity of the organism itself into a regeneration of its own tissues. 'The dog,' Claude Bernard remarked, 'does not get fat on mutton fat, it makes dog fat.'[16] This *internal* work of the organism, the work of forming and restoring its own matter, also constitutes the content of an opposite process, that of assimilation.

The fundamental cycle of the processes performed in an organism can thus be represented in the following scheme: external energy entering the organism in one form or another is converted and assimilated by it. For that, however, it is not sufficient for the organism to be subjected to the appropriate influence while remaining passive; it itself must at the same time do some work. This work may be expressed either in internal processes alone or also in external movements, *but it must always happen*. Even the simplest organism needs to perform some work in connection with assimilation, in the form, for example, of the movement

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[16] Claude Bernard. *Lectures on the Phenomenon of Life Common to Animals and Plants*, Vol. I (Charles Thomas, Springfield, Ill. 1974), p 104.

of what is called protoplasmic streaming which carries off matter coming in from the external medium. No process of organic assimilation is therefore possible outside living, active matter. The chloroplast of green plants by which carbon dioxide is assimilated through the energy of sunlight, converts solar radiant energy into chemical energy only when it is incorporated in a living cell that has a certain structure. Isolated chloroplast in a colloidal solution is incapable, apparently, of such a transformation. Only as a result of processes performed with energy released through dissimilation can the structure of living matter be restored by substances (and energy) coming from outside, and the organism's life cycle again continued.

The energy process in living organisms is consequently connected with the breakdown and restoration of parts of the organism itself, i.e. always occurs as a process of dissimilation and assimilation. In contrast to an inanimate machine, whose parts remain unaltered (disregarding the process of wear and tear, which is not an essential condition of its operation), a living organism is in a state of constant *self-renewal*.

This property of organic matter has been noted by almost all those who have ever studied life. The founder of dialectics, Heraclitus of Ephesus, seems to have been the first to point it out. Leonardo da Vinci expressed the idea in the imagery of a self-renewing flame. This property of living matter was known and understood by Lavoisier; and Claude Bernard said that the fact of the inseparability of destruction and creation at every moment of life was a physiological axiom, a great physiological principle.

A philosophical, dialectical materialist exposition of this property was given by Engels, who was the first to regard life as a perpetually created and destroyed contradiction existing in things and phenomena themselves, which expressed the specific form of the motion of matter that began a new phase in the evolution of the material world's relations.

Thus, where we find manifestations of life, we also find a process of assimilation. The cessation of assimilation is at the same time the cessation of life. When matter ceases to arrive from outside, therefore, as in starvation, assimilation does not cease but now continues through conversion of the organism's less vital parts into other, more vitally important

structures, so that the organism seems now to consume itself (Claude Bernard). As Chossat's findings, for example, show, even when higher animals are starving, around half of all the matter composing their organisms can be converted into more vitally important structures, the greatest weight loss being in the fatty tissues and blood (93 and 75 per cent), and the least in nerve tissue (less than 0.2 per cent). This process of 'self-consumption' is even more striking in certain lower animals. A living organism is consequently never in a state that would allow it to be compared to a discharged battery; nothing but simply energy equalisation signifies not life but death, decay of the organism and its dissociation.

Similarly, wherever there are phenomena of life, there are also processes of dissimilation, because assimilative activity of any kind is impossible except through the energy of dissimilation. Both these basic processes, one of which cancels out the result of the other, always exist together side by side.

Wherever we find phenomena of life, therefore, we also find, on the one hand, a process of absorption by the organism of substances from the external medium that are then assimilated by it and, on the other hand, a process of discharge of the products of dissimilation by the organism. This two-way process of exchange of substances (metabolism) is the most significant feature of the interaction between living, i.e. protein bodies and the other bodies that are their nutritional medium. In Engels' definition,

> life is the mode of existence of protein bodies, the essential element of which consists *in continual metabolic interchange with the natural environment outside them*, and which ceases with the cessation of this metabolism, bringing about the decomposition of the protein[17].

Exchange of substances also exists apart form life, but the outward, formal similarity of the processes must not lead us astray. When, in Rumbler's famous experiment, a thin, shellac-coated glass thread was drawn into a drop of chloroform and then ejected as soon as it was freed of the shellac coating, that only demonstrated an outward model of the process of organic metabolism. The drop of chloroform, moreover, did not display an activity specific to a living body, and retained its existence unconnected

[17] Frederick Engels. *Op. cit.*, p 301.

with the process. Engels, in speaking of metabolism as the essential feature of life, remarked:

> Such metabolism can also occur in the case of inorganic bodies and in the long run it occurs everywhere, since chemical reactions take place, even if extremely slowly, everywhere. The difference, however, is that inorganic bodies are destroyed by this metabolism, while in organic bodies it is the necessary condition for their existence.[18]

The fact of organic metabolism is thus a fundamental fact of life, and it is from it that all the other functions of organic matter stem, viz. the maintenance of life, growth, and multiplication. Underlying it, as we have seen, is the common property of every living body, the property of self-renewal, in which the qualitatively special form of its existence is expressed.

The origin of life is therefore, above all, the rise of a new relation between the process of reciprocal action and preservation of the interacting bodies themselves. In inanimate nature the process of the reciprocal action of bodies is a process of continuous change of their bodies, of their destruction as such, and their conversion into other bodies, now slower, now faster, but never ceasing for an instant. 'A weather-worn rock,' Engels said, 'is no longer a rock; metal which oxidises turns into rust.[19] The interaction of inorganic bodies causes them to 'cease to be what they were'.[20] Conversely, cessation of all interaction (if that were physically possible) would lead to preservation of an inorganic body as it is, to its remaining constantly what it was.

In the organic world we find an opposite relation between the process of interaction and preservation of the interacting bodies. While any inorganic body ceases to be what it was as a result of interaction, the interaction of living bodies with other bodies is, as we have seen, a necessary condition for their continued existence. 'But what with non-living bodies is the cause of destruction, with albumen is the fundamental condition of existence,' Engels added.[21] Conversely, cessation or disturbance of the interaction of organic bodies with other bodies around them leads to their decomposition and death.

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[18] Frederick Engels. Op. cit., p 301.

[19] Frederick Engels. *Anti-Dühring* (Progress Publishers, Moscow, 1977), p 104.

[20] *Ibid.*

[21] *Ibid.*

The transition from processes of reciprocal action in the inorganic world to such processes as the form of existence of living bodies thus involves a radical change in the fundamental relation between these processes and maintenance of the interacting bodies' existence. The relation is converted into its opposite. At the same time, the new relation, which characterises life, does not simply or mechanically replace the old one. It becomes established *on the basis of* this former relation, which is maintained for the *individual elements* of the living body, which are in a process of continual destruction and renewal. For the living, interacting body remains itself a whole precisely because its separate particles are decomposing and regenerating again. This means that the new relation, which characterises life, does not simply eliminate the former relation between the process of reciprocal action and the existence of the interacting body, but removes it dialectically.

This radical change, which forms a nodal point, a leap in the development of matter during the transition from its inorganic forms to its organic, living forms, is expressed from yet another, very important aspect.

When we consider any process of reciprocal action in the inorganic world, it turns out that both interacting bodies stand in fundamentally the same relation to the process. In other words it is impossible in the inorganic world to tell which body is active (i.e. the acting body) and which is passive (i.e. the body acted on) in a given interaction. The distinction has only a quite arbitrary sense in the inorganic world. When, for example, we describe one of two mechanically colliding physical bodies as moving, and the other as stationary, we always have in mind some system relative to which alone the terms 'moving' and 'stationary' have meaning. But in terms of the content of the process itself of the changes undergone by the bodies involved in it, it is quite immaterial which of them is moving in relation to the system, and which one is stationary. The same applies to a chemical reaction: it is irrelevant whether we speak of the action of zinc on sulphuric acid, or of the action of sulphuric acid on zinc. In both cases one and the same chemical process is being thought of:

$$Zn + H_2SO_4 = ZnSO_4 + H_2.$$

We find a fundamentally different situation in the case of the reciprocal action of organic bodies. In the interaction between a living protein body and some other body which serves as nutritional matter for it, the relation of the two bodies to the interaction itself will quite clearly be different. The body absorbed is the object of the living body's action and as such is annihilated, but of course, it in turn acts upon the living body, whose elements likewise undergo change. But, as we have seen, the living body maintains its existence in normal cases and does so by virtue of changes in its separate particles. This specific process of self-renewal does not apply equally to both interacting bodies, but is inherent in the living body only.

> Life, the metabolism that takes place through nutrition and excretion (Engels wrote) is a self-implementing process which is inherent in, native to, its bearer, albumen, without which the latter cannot exist.[22]

We can therefore say that the process of life, being one of reciprocal action and exchange between bodies, belongs, however, as a self-renewal process, i.e. as a *living* process, only to a living body, which is also its active subject.

The process to which, in the inorganic world, the bodies involved stand in fundamentally the same relation, is converted, at the level of organic life, into a process to which the living body's relation will be essentially different to the inorganic body's. For the former its change is an active, positive process of self-preservation, growth, and reproduction; for the latter its change is a passive process inflicted on it from outside. This can be put in another way, as follows: the transition from those forms of reciprocal action that are typical of the inorganic world to the forms of interaction inherent in living matter finds expression in the fact of a differentiation into *subject* on the one hand and *object* on the other.

From the standpoint of the fundamental path of scientific study of vital processes, this fact of the differentiation of an active living body possessing an independent power to react is one of fundamental significance. We shall therefore have to dwell specially on certain conclusions that follow from it.

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[22] Frederick Engels. *Anti-Dühring*, p 104.

Knowledge of a thing is only possible in its relation to other things, in reciprocal action with them, in motion. Only in motion, in interaction, does a thing reveal its properties. But knowledge of properties is also knowledge of the things themselves. We cannot say anything about bodies apart from their motion, their interaction, their relation with other bodies. 'If you know all the qualities of a thing, you know the thing itself.'[23]

The properties of any body are thus only revealed in its relation to other bodies. This relation is not, of course, just an intellectual, just a logical one. It is always a real interaction of bodies. We can, it is true, know a body's degree of elasticity, for example, by the mental act of comparing it with a unit of elasticity, but what underlies this act? Always, it goes without saying, a practical testing of the body by another body having a degree of elasticity already known to us—again originally in practice. Only on that condition does the mental operation of comparing the elasticity of the body with our selected 'degree of elasticity', and expressing it in units of measurement of some sort, or even as a simple sensory impression become possible. The body as it really is cannot, consequently, be observed other than in its real interaction with other bodies, which are objects for it: *non-material being* is a *contradictio in adjectum.*

> A being that breathes (Feuerbach wrote) is *of necessity* linked with a being that is outside it; its *essential* object, that to which it owes what it is, is *outside* it —... the object to which a being is of necessity related is nothing else than its *disclosed* essence.[24]

For Feuerbach this relation was an objective and not at all a subjective one ('an object is not for the "Ego" but for the "Non-ego" within me, as Fichte expressed it');[25] it is a real, practical relation, not a mental one, not an ideal one ('the question of being,' Feuerbach stressed, 'is precisely a practical one').[26]

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[23] Frederick Engels. Special Introduction to the English edition of 1892 to *Socialism: Utopian and Scientific.* In Karl Marx and Frederick Engels. *Selected Works*, Vol. 3 (Progress Publishers, Moscow, 1970), p 102.

[24] Ludwig Feuerbach. Grundsätze der Philosophie der Zukunft. In L. Feuerbach. *Philosophische Kritiken und Grundsätze* (1839—1846) (Verlag Reclam, Leipzig, 1969) pp 197-198.

[25] *Ibid.*, p 248.

[26] *Ibid.*, p 239.

Feuerbach's point of view, however, was limited in that he regarded a living being's relations to objective reality as those of a passive one. For him, therefore, the essence of *any* being was exhausted by the sum total of the relations into which it entered with the objects of the world around it. That is so, however, only when we are dealing with relations that are inorganic in type. The essence of marble is in fact exhausted by the varied properties it exhibits in its various reactions with other bodies. In relation to an elastic body, it reveals itself as a body possessing elasticity, in relation to a beam of light, as a body reflecting light waves of certain frequencies, in relation to electricity, as a dielectric with a certain dielectric constant, in relation to acid, as a collection of molecules that decompose and give off carbon dioxide, and so on and so forth. The totality of these many-sided characteristics of marble also includes the features of its internal structure, the laws of its inherent forms of interaction, in short, what it *is*.

It is another matter when the interacting body is a living being, when its relations to other bodies are active relations mediated by its inherent internal states and processes. We cannot, of course, say that a plant's death during a forest fire expresses its essence as a *living* body. Those of its properties that it exhibits then, though they belong to it, still do not essentially characterise life itself, or its essence as the *subject of a living process*. Its essence as a living plant is not revealed directly in the capacity of its cells to lose moisture and be scorched, but, on the contrary, in its capacity, with an extreme rise of temperature, to curl its leaves, vary its stomatal openings, etc., i.e. precisely in the fact of its active counteraction to the effect of overheating. A living creature, in 'manifesting' itself in its objects, actively asserts its existence, its life. Even its death itself, in normal conditions, is nothing more than the natural result of its life. This means that we cannot view the being of a living creature only objectively, i.e. not from the angle of a subject asserting its own life, but as a passive, albeit sentient, process for it (in both senses of 'sentient'). Such a view would inevitably lead—as it actually led Feuerbach—to an identifying of the subject's essence with its being: *'That which is my essence is my being'*.[27]

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[27] Ludwick Feuerbach. *Grundsatze...*, p 237.

Feuerbach's mistake was in regarding even man simply as a passive thing, as a'sense object',[28] and not as 'sentient activity', not subjectively.

Human life, human 'subjectivity', is, of course, a unique life, a unique subjectivity. Man himself creates the conditions of his existence, and does not find them ready made in Nature. But even if we abstract *human* life from this peculiarity, i.e. speak of life in its *universal* form, we must maintain the standpoint of recognising the subject's capacity to be active. For *any* living being, an object is not only that in relation to which it exhibits some one of its properties, but is also an 'object asserting its life', an object in relation to which the living creature is not simply passive, but also active, striving or *impassioned*.

For the sun a green plant is an object in which it manifests its life-giving power, but the plant does not assert or in fact determine the sun's being, nor does the sun seek out the plant. For the plant, the sun is not only an object that reveals its (the plant's) capacity to assimilate carbon dioxide through solar energy, but is also the primary condition of its life, an object that it actively strives for. The plant ends its stem toward the sun, stretches out its branches and turns the surface of its leaves toward it. These movements of the plant are not the *direct* result of sunlight alone; they are determined as well by its general state in regard to other vital processes; with certain internal conditions the branches of the same plant will wilt under the sun and its leaves shrivel; quite a different picture arises—the plant is 'averse' to the sun.

The fundamental change in the relation between the interaction process and the existence of the interacting bodies noted above, which we observe in the transition to living matter is thus also expressed in a change in the relation between a creature and its object. This relation, too, is not immutable, but is an evolving one. It is different in the inorganic world and in the organic, and it is different again for the animal and for man.

The processes concerned, therefore, which embody the subject's specific relations with the objective reality around it, have to be distinguished from the outset from other pro-

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[28] *Ibid.*, p 254.

cesses. If, for example, unicellular algae are put into a quite concentrated solution of acid, they die instantly; it can be assumed, however, that the organism itself does not make an active response to the substance affecting it. This action will consequently be an objectively negative one destroying the organism, but from the standpoint of the organism's reactivity it may be neutral. It is another matter if we treat an amoeba in the same way; if we pour acid into the water around it, the amoeba will draw in its pseudopods and assume a spherical shape, i. e. will display a certain active response. Such, too, is the slime-secreting reaction of certain rhizopods, the motor reaction of infusoria, and so on. In this case the objectively negative influence is thus also negative in regard to the organism's activity induced by it. Although the end result may be the same in both cases, the processes themselves are profoundly different. The same distinction exists as well in organisms' reactions to objectively positive influences.

The necessity of this distinction needs to be noted specially because, in spite of its obviousness, it is far from always taken into account. And it is to that circumstance that extreme mechanistic theories owe their appearance, theories for which the fact that an organism obeying the force of gravity moves toward the centre of the earth, and the fact that it actively strives for food, are in principle facts of the same order.

The specific processes that realise some vital, i. e. active, relation of the subject to reality we shall term processes of *activity*, in distinction to other processes.

We shall also, accordingly, limit the concept of object. It is normally used in a dual sense: in the broadest one as a thing standing is some kind of relation to other things, i. e. as 'a thing having existence'; and in a narrower sense—as something withstanding (German *Gegenstand*), resistant (Latin *objectum*), that to which an act is directed, i. e. as something to which precisely a living creature relates itself as the *object of its activity*—indifferently as outward or inward activity (e. g. *object of nutrition*, *object of labour*, *object of meditation*, etc.). From now on we shall employ the term *object* precisely in this narrower, special sense.

Any activity of an organism is directed to some object or other; activity without an object is impossible. Consideration of activity therefore requires us to single out and

distinguish that which is its real object, i. e. the object of an active relation of the organism.

All lower filtrable organisms (certain larvae living in water, copepods, all Tunicata, etc.), for example, are capable, as we know, of altering their activity in connection with a change in the aqueous medium; in that connection it can sometimes be said with confidence that the change in the organism's activity is specifically linked with a definite activating property of the medium, for example with a greater or less concentration of nutrients. Imagine, however, that we have artificially altered the medium, for example, of a daphnia, by putting it into water that lacks its nutrient plankton but contains particles of some neutral inorganic substance; the daphnia would react to this by a slackening of the movements that create a flow of water to its ventral slit. Is the observed slackening of the water flea's filtering movements a response to the absence of plankton in the water? Or is it, on the contrary, a response to the presence in it of unassimilable particles? Or does it, finally, depend on some other moments still, not considered by us? Only by answering these questions can we decide precisely *what* property of the medium is the object of the daphnia's activity, i. e. with what kind of a relation we are dealing with here.

Thus, the principal 'unit' of a vital process is an organism's activity; the different activities that realise its diverse vital relations with the surrounding reality are essentially determined by their object; we shall therefore differentiate between separate types of activity according to the difference in their objects.

2

The main feature of living organisms' interaction with the medium around them, as we have seen, consists in the fact that any response (reaction) of an organism to an external influence is an active process, i.e. is performed through the energy of the organism itself.

Organisms' property of coming into a state of activity under the influence of their medium, i.e. the property of irritability, is a fundamental one of all living matter and is a *sine que non* of metabolism, and that means of life itself as well.

What is the life process in its simplest, elementary forms? In present-day scientific notions, the primitive, first viable organisms were protoplasmic bodies suspended in an aqueous medium that had several properties permitting the simplest form of metabolism and the simplest structure of the organisms themselves: viz. uniformity, a capacity to dissolve the substances necessary to maintain the simplest life, relatively high thermal stability, etc. On the other hand, these primitive organisms themselves also possessed properties that provided a possibility of their simplest reciprocal action with the medium. Thus, as regards primordial organisms, we must assume that they obtained nutrients from the surrounding medium by way of direct adsorption; their activity was consequently expressed only in the form of inner movements serving processes of intermediate transformation and direct assimilation of assimilable substances.[29] And that means that in normal conditions dissimilative processes also occurred in them only in connection with those influences that could *of themselves* determine a positive or negative process of assimilation, i.e. the process of maintaining life.

Thus, in order for life to occur in its simplest form, it was necessary and sufficient for the living body to be irritable in relation to the activating substances or forms of energy which, as the result of several subsequent transformations within the organism, could lead to a process of assimilation capable of compensating the breakdown (dissimilation) of the organism's own substance, through the energy of which the reaction induced by these influences themselves occurs.

In other words, in order for the life of the simplest protoplasmic body—the original coarcerative droplet or 'protoamoeba—to be materialisable, it was necessary for it to be able to assimilate the appropriate substance or energy from the surrounding medium. But the process of assimilation is only realised as a result of the activity of the organism itself. It is indifferent whether this activity occurs solely in the form of inner activity or also in the form of external activity; it always has to be and it always does occur through partial breakdown of the substance's constituent particles and a drop in their energy potential, i.e. through dis-

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[29] See: A. I. Oparin. *The Origin of Life* (FLPH, Moscow, 1955), p 80.

similation. For every time we have some external influence leading to assimilation, we also have some dissimilation associated with the organism's activity induced by the given influence. And if assimilation exceeds dissimilation, we will observe the phenomenon of growth, and after a certain limit the phenomenon of multiplication. If, on the contrary, however, dissimilation is not compensated by assimilation, we will observe a phenomenon of decay of the organism, because the lack of assimilants coming in from outside will then be covered through 'self-consumption' of the organism.

Can we also assume, as *necessary* for the simplest life, forms of activity by which the organism's energy expenditure associated with processes induced by some influence or other, cannot be restored to some degree by the activating property (substance or energy)? Understandably, we cannot. We also cannot, moreover, consider such activity stably possible in any way in the conditions of the simplest life.

We can thus make the following, for us very important, statement: it is sufficient, in order to realise life in its simplest form, for an organism to respond by active processes only to those influences that are capable in themselves of governing (positively or negatively) the maintenance of its life.

It is also obvious that the simplest viable organisms have neither specialised organs of absorption nor specialised organs of movement. As for their functions, the main, general one that is absolutely essential is what may be called *simple irritability*, which is expressed in the organism's capacity to respond by specific processes to some influence of vital significance.

This form of the simplest organisms' reciprocal action with the medium is not preserved unaltered in subsequent evolution.

The process of biological evolution, which takes the form of a constant struggle of heredity and adaptability, is expressed in an ever greater complication of the processes that affect the exchange of substances between an organism and its medium (environment). These processes become more complicated, in particular, in the sense that more highly developed organisms prove to be able to maintain their life through an increasing number of the substances and forms of energy assimilated by them from their environment. A complex chain of processes maintaining the life of organisms arises, as well as specialised, inter-connected forms of irrita-

bility in relation to the appropriate external influences.

The development of organisms' vital activity, however, does not consist simply in its primarily quantitative complication.

In the course of progressive evolution, on the basis of a complicating of the processes of metabolism, changes of a general type in the organism's reciprocal action with the environment occur. Organisms' activity is qualitatively altered; a qualitatively new form of interaction and a qualitatively new form of life arise.

Analysis of the purely factual state of affairs indicates that irritability develops during subsequent evolution not only along the line of organisms' becoming capable of employing ever newer sources and ever newer properties of the environment to maintain their life but also along the line of organisms' becoming irritable as well in relation to effects that are not *in themselves* capable of determining their assimilative activity and exchange of matter with the environment either positively or negatively. A frog, for instance, orients its body in the direction of a faint rustle reaching it; it is consequently irritable in relation to this effect. The energy of the sound of the rustling that acts on the frog's organism is not, however, assimilated by the organism at any stage of its transformation in the latter, and is not in general involved in the frog's assimilative activity. In other words this effect cannot, in itself, serve to maintain the organism's life; on the contrary, it gives rise only to dissimilation of the organism's matter.

What, in that case, is the vital, biological role of organisms' irritability in relation to influences of this kind? It is that, in responding by certain processes to influences that are not in themselves directly, vitally significant influences, an animal comes nearer to the possibility of assimilating the matter and energy needed to maintain its life (e. g. to the possibility of capturing or swallowing an insect rustling in the grass, whose matter serves it as food).

The new form of irritability considered above, inherent in more highly organised animals, consequently plays a positive biological role, because it mediates the organism's activity directed to maintaining life.

This change in the form of organism's reciprocal action with the environment can be expressed schematically as follows: at a certain stage of biological evolution an organism

enters into active relations as well with influences (let us call them type α) whose biological role is governed by their objective, stable link with effects that are directly biologically significant (let us call them type *a*). In other words activity arises whose specific feature is that its object is determined not by its own relation to the organism's life but by *its* objective relation to other properties, to other influences, i.e. by the relation α :a.

What is the significance of this ensuing change in the form of life from the angle of the organism's functions and structure? Obviously, the organism must now display processes of irritability of two kinds: (i) irritability in relation to influences *directly* necessary for maintenance of its life (*a*), and (ii) irritability as well in regard to those properties of the environment that are not directly connected with maintaining its life (α).

We must note that no essential importance was attached for a long time to this fact—that of the development of irritability establishing a relation between the organism and those excitatory properties of the environment that are not in themselves able to determine the organism's life. It was first distinguished by Pavlov. Only Child, among writers in other countries, pointed out the fundamental importance of this fact clearly enough, though, it is true, a rather different aspect of it interested him from that which interests us, but for all that, he specially stressed it.[30] From the angle of our problem this fact is one that is really decisive.

The first and basic assumption of our hypothesis is just this, that the function of the processes that mediate the organism's activity directed to maintaining its life is nothing other than the function of *sensitivity*, i.e. the capacity for sensation.

On the other hand, the temporary or permanent organs that are organs of transformation embodying the processes of the organism's link with those influences that are objectively associated in the environment with effects necessary for the maintenance of life, but that in themselves cannot fulfil that function, are nothing else than organs of sensitivity. Finally, those specific processes of the organism that arise through realisation of the form of irritability that we

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[30] See: C. M. Child. *The Origin and Development of the Nervous System* (University of Chicago Press, Chicago, 1921), pp 21-22.

call sensitivity are also processes that form the basis of phenomena of sensation.

Thus we can preliminarily define sensitivity as follows: sensitivity (capacity for sensation) is genetically nothing other than irritability in relation to that kind of environmental influence that brings the organism into correlation with other influences, i. e. that *orients it in the environment* by performing a signalling function. The necessity for the rise of this form of irritability is that it mediates the organism's main vital processes that are now taking place in more complicated conditions of the environment.

Processes of sensitivity can arise and become consolidated in the course of biological evolution, of course, only granted that they are caused by properties of the environment that are objectively associated with properties directly biologically significant for animals; otherwise their existence would not be biologically justified in any way and they would have to be modified or would disappear altogether. They must necessarily, consequently, conform to the objective properties of the environment and *correctly reflect them in appropriate connections*. In our example of the frog, for instance, the processes induced in it by rustling reflect features of the given, influencing sound in its stable link with the movement of insects that serve as the frog's food.

Originally animals' sensitivity was apparently undifferentiated, but its evolution necessarily led some effects being ever more accurately differentiated from others (for example, the sound of rustling from all other sounds), so that the environment's excitatory properties gave rise to processes in an animal that reflected these influences in their difference from other ones, in their qualitative peculiarity, and in their specific character. Undifferentiated sensitivity was transformed into more and more differentiated sensitivity and gave rise to differentiated *sensations*.

How did the transition from the irritability inherent in any living body to primordial sensitivity come about, and then to the differentiated sensations that are already a property of much more highly organised animals? Let us recall that the processes realising metabolism become complicated in the course of biological evolution in the sense that the influence of a whole number of different substances and forms of energy on the organism becomes necessary in order to assimilate matter from the external environment.

The separate processes induced by these different influences are of course mutually dependent and conditioned by one another; they form a *single*, complex process of the exchange of matter between the organism and the environment. We can therefore suppose that some of these influences necessary for the organism's life naturally operate at the same time in the role of influences inducing and directing processes coordinating the organism with other influences, i. e. begin to have a *dual* function. In the course of subsequent evolution, in connection with changes in the environment, sources of food, and corresponding changes in the structure of the organisms themselves, the independent role of some of influences, previously significant in themselves, becomes inessential, or even disappears altogether, while their impact on other processes that materialise the organism's relation to those properties of the environment on which its life directly depends is maintained. They are consequently now converted into effects that only mediate realisation of the organism's principal vital processes.

Correspondingly the transformer organs that used to perform the function of external metabolism also lose that function now; while preserving their irritability, they are converted into organs of sensitivity, which means that whether an organ of the simplest animals is one of external metabolism or of sensitivity can only be decided by analysing the role its associated processes perform.

Cells have been described in certain green plants, for example, that gather light where there is a concentration of chloroplasts (so-called Haberlandt cells).[31] Are they, however, organs of sensitivity? As we know, green plants assimilate the energy of sunlight, by which they also synthesise substances coming into them from the environment. Let us assume that the organs concerned really are organs in which a definite stage in the transformation of the energy of light takes place. As a result of the next complex chain of processes, however, this effect leads to the formation or restoration of the plant's material. These cells consequently are organs of external metabolism.

It is another matter when an organ excitable as regards light provides the basis for transformations of activating

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[31] See: G. Haberlandt. *Die Sinnesorgane des Pflanzen* (Verlag Barth, Leipzig, 1904).

energy that in themselves do not lead to maintenance of the organism's life but only link the organism with other influences, i.e. mediate its relation with them. Such, for example, are the special organs for transforming light in animals that are at a higher stage of evolution—organs of photosensitivity and light sensation.

The transition from primordial irritability to its special form that we call sensitivity takes place through a process of complication and extention and, on the other hand, contraction of organs' functions that leads to their specialisation as organs of sensitivity.

What, then, is the main condition for sensitivity to arise in animals, and for special organs of sensitivity—organs of sensation—to be developed? We can assume that this main, determinant condition is the transition from life in a uniform medium to life in a more complicated environment of discrete objects, the transition from unformed sources of life to ones formed as things.

When we speak of sources of life unformed as things, we have in mind those that maintain organisms' existence, like the chemical substances dissolved in the aqueous medium in which a given organism lives, or the energy of light and heat. A specific feature of this kind of life source is that these sources of life are properties of the environment capable of inducing active processes in an organism simply by operating on it by themselves, i.e. directly.

The environment shaped as things, on the contrary, and physically shaped sources of life, operate (for the organism) not only by their properties capable of exerting some biological effect on it, but also those properties stably associated with them (like form, colour, etc.) which, though biologically neutral, at the same time objectively mediate the formed substance's properties essential for life. The formed body, before affecting the organism by its chemical properties (e.g. a food substance), affects the organism by its other properties like bulk, resilience, etc. That creates an objective necessity, as well, for the rise of mediated relations with the environment on the side of the animals themselves. The transition to existence in the conditions of a complex environment formed as things is therefore expressed in organisms' adaptation to it taking on a qualitatively new form associated with reflection of the properties of a material, objective reality of things.

This can be expressed in another way, as follows: the origin of sensitivity is connected with organisms' transition from a homogenous medium, from a 'medium-element', to one formed as things, to an environment of discrete objects. The organisms' adaptation, which is always, it goes without saying, a kind of reflection of properties of the environment by them, now acquires the form as well of reflection of affective properties of the environment *in their objective connections and relations*. This is also a specific form of reflection for the psyche, *object* reflection. For the object, i.e. a material thing, always has several interconnected properties; in that sense it is always a knot of properties.

At a certain stage of biological evolution the former single complex process of reciprocal action realising organisms' life thus bifurcated as it were. Some of the environment's influences affected the organism as determinants (positive or negative) of its very existence, others only as stimuli and directors of its activity.

There was also, correspondingly, a bifurcation of organisms' vital activity.

On the one hand the processes that were directly linked with the support and maintenance of life became differentiated. They constitute the primary, initial form of organisms' vital activity, underlying which are phenomena of their primordial irritability.

On the other hand processes became differentiated that did not directly have life-supporting functions and simply mediated an organism's links with those properties of the environment on which its existence depended. They constituted a special form of vital activity that also underlay organisms' sensitivity and their psychic reflection of the properties of the external environment.[32]

The processes that constitute both these forms of organisms' vital activity are in a complex, dynamic relationship, so that it is possible for contradictions to arise between them.

Let us take an example. If a bit of white paper is attached to a thread and fluttered in front of a toad, the latter will try to catch it, i.e. will react to the visually perceived motion as to the movement of a flying insect. The effect of the

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[32] This hypothesis of the genesis and nature of sensitivity was developed by the author jointly with A. V. Zaporozhets (1936).

moving paper, which is the source of light rays reflected by it, stimulates the animal's activity. This is activity connected with sensitivity. Let us, however, do it so that the toad cannot catch the paper, by putting a sheet of glass between the animal and the moving paper (the toad does not visually notice the glass barrier). It proves that, in these conditions, attempts to catch the paper continue for quite a time and then only gradually cease. The explanation is that this effect is quite stably associated in the toad's normal conditions of existence with other properties possessed by the flies that serve as its food, i. e. with those properties that enable processes that constitute the principal form of vital activity (those on which the animal's existence directly depends) to be performed.[33]

The observations cited show that those properties in relation to which a given animal is sensitive and whose influence stimulates processes that constitute the primary form of vital activity, can be separated from those with which realisation of its second form is connected. The colour of a substance, for example, can be separated from its food properties. The processes themselves that constitute the content of the first form of animals' vital activity are also correspondingly differentiable from those constituting the content of its second form.

In general, we must note, if one or other of these processes (and the stimuli that give rise to them) can be separated from processes (and stimuli) that directly fulfil a life-support function, then that is a sign that they are connected with phenomena of sensitivity; if, however, such separation is impossible, then that means that the organism's primary irritability underlies them.

The possibility of separating these processes from one another also makes for disparities between them and creates a new form of contradiction in the organism's vital activity as a whole.

Let us return to the toad experiment cited above. The toad's activity caused by our action, like any activity of a living organism, is performed through dissimilation. In

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[33] In this example we have used facts from the experimental research described by Buytendijk. See: F. Buytendijk. Les differences essentielles des fonctions psychiques de l'homme et des animaux. *Vues sur la psychologie animale.* (Librairie philosophique Vrin, Paris, 1930), pp 35-94.

normal conditions it leads subsequently to the toad's capturing, swallowing, and assimilating part of the insect's matter.

Things were deflerent in the case we described. The paper caught by the toad could not be assimilated and consequently could not lead, either directly or indirectly, to restoration of the matter disassimilated by its organism during the preceding activity. In other words the animal's activity aimed on the whole at maintaining its life leads in these conditions to the opposite result, to exhaustion of the organism, and, if this relation of the processes were continued in the animal's subsequent activity, to its death.

How can this contradiction be resolved? Only by one, single means, and that is by altering and reconstructing the processes constituting the primary form of the animal's vital activity. So, if we now continued our experiment with the toad and let it catch the paper, it would spit it out and immediately stop trying to catch it any more. But if, after that, we showed it a real fly, it would again renew its attempts and, moreover, as a result of many repetitions of these experiments, it would only catch real flies, and not seem to notice the moving paper at all. That means that its reflection of the excitatory properties that stimulate activity (form, colour, character of movement) has become more differentiated.

The essential characteristics of activity connected with sensitivity and capacity for sensation are thus the disparity, on the one hand, of the environment's properties that are reflected and that stimulate the animal's activity, and those, on the other hand, which, by affecting the animal as a result of its activity, themselves determine, positively or negatively, the maintenance of its existence.

Development of this disparity in the course of animal's adaptation to a changing environment ever more varied in its properties also leads to a further complication of their reflection of the external reality around them and to a further development of their psyche.

3

To answer the question of the genesis of a rudimentary psyche we took the path, not of considering functions and organs taken separately, but of analysing and describing

integral forms of life. That way, we have found that there are two principal, qualitatively different forms of life. One, the simplest, can be called pre-psychic life. The other is life associated with reflection of the properties of reality in their objective connections and relations, life mediated by sensation. The transition to this form of life is also, apparently, nothing else than the transition from pre-psychic activity (i.e. not mediated by reflections of objective reality) to activity mediated by psychic reflection.

The psyche and psychic activity thus function for us, not as something added to life, but as a singular form of the manifestation of life that necessarily arises in the course of its evolution.

The answer to the problem of the origin of the psyche that we have outlined is, of course, only a preliminary scientific hypothesis. We shall therefore have to analyse it specially to see how far it is probable both theoretically and purely factually.

Let us consider this hypothesis first from the angle of the answer in principle to the problem of the genesis of psychic reflection.

The first point that follows from the conception of the life process set out above is the fact that any kind of change undergone by an organism in the course of its reciprocal action with the environment is a plastic change, irrespective of whether it is a change of its separate micelles or a change of whole structural formations. That means, *from this aspect*, that the organism's states reflecting external influences do not differ at all, in principle, from those, also reflecting external influences, that are also inherent in inorganic bodies. The actual difference between these states of inorganic and organic bodies is disclosed to us from a quite different aspect. In contrast to what we observe in the world of inorganic relations, a necessary condition, for a living organism, of its change through some influence or other is that it itself should perform a certain activity in connection with this influence (be it only in the form of internal movements); and the capacity for this activity is nothing else than the property of irritability. The result of an influence on an organism is thus not only governed by the affective property but also depends on the processes of the organism itself by which it specifically reacts to the influence.

The effect of sunshine is always reflected somehow or other in a green plant, but the plant may react quite differently to the degree of illumination to which it is subjected. If the state of its chlorophyl transformer is such that conversion of the solar energy acting upon it can be realised normally and if, thereby, the process of assimilating carbon dioxide and forming the corresponding complex compound is possible, then and only then will illumination of the plant have transformation of this compound into a more energy-stressed structure as its end result. Otherwise the effect of the illumination will be expressed quite differently and will lead, for example, partly to simple heating of the plant's cells, and partly to a number of other side effects.

This means that, in contrast to the phenomena of reflection in the inorganic world, a living organism's reflection of one influence or another is necessarily mediated by the activity of the organism itself. It is therefore never a passive process.

We must therefore stress that, in establishing the dependence of the result of an external influence on an organism on its state, and on processes linked with that, we have brought out only one side of the existing relationship, and that we have arrived at it from a direction *opposite* to the real genetic dependence, i.e. the dependence of the organism's states and processes themselves on repeated influences from environment. But it is that dependence, which expresses the organism's property that is called capacity for *adaptation*, that underlies the above-mentioned converse dependence. Since changes of a living body's structure, state, and processes, and that means also of its activity, are governed by external influences, we can consequently say that *its organisation itself and its activity are a reflection of the environment's objective properties.*

Thus, in contrast to inorganic bodies, a living body does not passively 'submit to an influence' but undergoes one external influence or another in the course of its activity directed to the maintenance of life; by virtue of that the process of its change which reflects the environment's objective properties is itself also a directed, 'biassed', process, i.e. one that is inseparably linked with the living body's very existence and that constitutes its most essential and most necessary condition. For a body incapable of reflect-

ing external influences in a 'biassed' way is incapable of adaptation, such a body cannot develop its life, cannot live.

A long path of evolution lies between a property similar to sensation, i.e. the property of reflection inherent in all matter, inorganic matter included, and reflection as the simplest form of psychic reflection. During the transition to the organic world, a qualitatively new, higher, and more complicated form of reflection had already arisen. This new form, however, is higher not at all in the sense of the greater precision of reflection in a mirror than in, say, the water of a brook, or the greater strength of an impression cut in stone than of one in clay. The development of reflection during the transition to living matter is expressed in its originally having lost just that character of a direct impression that is met in some cases of reflection in the inorganic world. But, at the same time, it also loses its passive, inert, and random character. For the first time it becomes a *sine qua non* of the body's very existence. The main thing is that it becomes capable both of further qualitative change and specialisation taking place along with the change and specialisation of the vital processes with which it is now internally connected. It is therefore once again capable of acquiring the precision of mirror reflection in subsequent evolution with the rise of psychic life, and now becomes rather like the reflection in the fairy-tale mirror, in which is seen not only what is happening directly before it but also the whole real world, even that which has never directly thrown its rays on the mirror.

The change in the process of reflection during the transition to living matter possessing a capacity for sensation also consists in this, that whereas, in the case of direct, unmediated processes of exchange, the dynamic states experienced by an organism are governed only by the relation of the affective property to the organism itself, in the case of mediated vital processes the states connected with them, although they, too, pertain to the subject, are governed by the objective relation of the environment's properties which mediate its processes. That is why these relations are objectified and acquire the character of a subjective reflection of the objective properties of external reality. For a property can function as *objective* for the subject only in relation to another objective property and not directly to the subject itself. And in order for it to be reflected

by the subject at the same time, also, as objective, it is necessary for both relations to be represented in a unity. We find the unity of these relations for the first time in that form of life which is realised by the subject's activity that is mediated by the objective links of the properties of reality. According to our hypothesis that, too, is life internally connected with a higher type of reflection, i.e. psychic reflection whose elementary form consists of phenomena of the simplest sensitivity. The contradictory character of the concrete unity of these relations, however, is what creates a need for further development, the necessity for the subject's ever more correct and fuller reflection of the reality around it.

Thus, from the angle of our hypothesis, sensitivity arises as a rudimentary form of psychic reflection, during the evolution of the simple irritability that is inherent in any viable body, even the simplest.

We must also note that our hypothesis rejects from the start any attempt to approach reflection from the angle of the notorious 'principle of the specific energy of the sense organs' (J. Müller), i.e. from the standpoint of a metaphysically understood dependence of sensation on the structure of the subject's organs of sensation. From it follows, rather, another principle, which can be called that of 'the evolution of organs of specific energies', according to which *the very development and specialisation of organs of sensitivity is governed by the need adequately to reflect the objective material reality with which the organism is entering into ever more complex relations.*

Does it also hold for higher levels of development that phenomena of sensitivity characterise precisely those processes of living organisms that are evoked only by signalling effects, effects that mediate their relations with other effects? At the very first, superficial glance it may seem that there are facts that contradict this proposition. Our relation to food, for instance, is a basic, vital one; at the same time, however, we have a varied sensitivity to it. In reality, of course, this fact, too, like many others of the same kind, does not contradict our main thesis; on the contrary, rather, it supports it. If we ponder this point even briefly, we shall readily understand that the specific properties of the foodstuffs that evoke some sensation or other in us—visual, tactile, olfactory, and even gustatory—are just not iden-

tical with the properties that make a substance satisfy the need for food. We can communicate these properties artificially, i.e. the attributes that mediate our relation to the substance's food qualities proper, to some other, non-foodstaff; conversely, we can also communicate properties to a foodstuff that are normally not linked with food at all.

Closer analysis of phenomena related to higher stages of development indicated that effects that evoke sensation in this case are also always ones that orient the organism in the environment, i.e. mediate its relations with other properties objectively connected with them. On the contrary, in the case of relations that are realised in respect of effects that never fulfil an orienting function, we are unable to ascertain phenomena of sensation and sensitivity. We completely lack sensitivity, for example, directly to oxygen, as we know, although its presence in the air is a primary condition of life for us. This is understandable, for it is precisely because of its very great importance for the maintenance of life that oxygen has never been able to fulfil orientation and signalling functions.

Matters are rather different as regards the effects of radiant energy. The effect of rays of a certain frequency is necessary, of course, for the development of higher animals; puppies, for example, that are completely deprived of sunshine, die. This form of excitatory energy thus evokes active biological processes in higher animals that are directly necessary for the maintenance of life. On the other hand, animals are at the same time sensitive to sunshine (normally, it is true, not to the ultraviolet end of the spectrum), special organs of light sensitivity, visual organs, are developed in them and, moreover, to a high degree of perfection. In this case, consequently, we observe a dual relation, as it were, to one and the same effect, corresponding to the dual form of irritability toward it.

In approaching the problem of sensitivity at the higher levels of the evolution of life, we must bear yet another circumstance in mind. This is that, in the course of organisms' evolution, their links with the environment's affective properties that directly govern assimilative processes generally do not take on a direct form, which happens because of the division arising between the organism's so-called inner environment and its external one. The numerous relations

that link higher animals' external and inner environments together are therefore ones that mediate the principal (assimilative) processes of the organism's life and that must consequently be linked with phenomena of sensitivity, which are becoming more and more diverse and differentiated.

Phenomena of sensitivity are altered qualitatively, of course, during evolution, as well as quantitatively. The primitive sensitivity inherent in the lowest animals is therefore quite different from the forms we find in higher animals and man. The simple fact of the development of intraception and proprioception already forces us to approach the very definition of sensitivity at the higher levels of evolution quite differently as well.

Just as with any scientific thesis that is the result of purely theoretical analysis, the fate of our hypothesis will be determined by how far it is able to serve as the basis for experimental research that can disprove it or concretise it and develop it further. But we must take it as only a first attempt at preparing the ground for penetrating this still enigmatic and obscure problem by concrete research, because we have no right to reject even the most tentative explanatory hypothesis in relation to these problems, although they are originally very far from the measure of factual substantiation that raises a hypothesis to the level of a scientifically substantiated thesis.

III. Investigation of the Functional Evolution of Sensitivity

1

It is a task of exceptional complexity to confirm and develop our hypothesis about the nature of sensitivity experimentally, and one that can only be solved by a whole system of research along many varied, intersecting lines of inquiry.

The main difficulty is to pass from the initial theoretical theses to concrete experimental data. The problem is

therefore at once the actual choice of the initial line of inquiry.

It was necessary first of all to choose between the two principal lines open to the researcher: viz. investigation of genetic material, i.e. animals (especially animals at the lowest stages of biological evolution), and direct investigation of man. Only the first line is the direct one here, of course. On the contrary, since it is a matter of the *origin* of sensitivity, the second way seems improbable at first glance and even paradoxical, it is, indeed a 'roundabout' way of reaching the main goal.

Nevertheless, we pursued this second line. The main argument in its favour was the, so to say, historical one: the traditional posing of the problem called for use of the subjective criterion in order to establish the facts of sensitivity, and that requirement, of course, precluded the possibility of experiments on animals.

On the other hand, research into the origin of sensitivity, given the existence of highly developed, specialised sense organs and a very complicated nervous organisation, runs into a two-fold difficulty right at the start. A purely theoretical question arises first of all, that of the legitimacy of drawing broad, general psychological conclusions from data obtained from man, who possesses a qualitatively unique, specific form of psyche.

The general objections that arise in this regard are understandable, but they are still often quite insufficient because it is impossible to be limited by abstract considerations in such cases, and it is necessary to make a preliminary analysis of the concrete thesis that is the object of experimental treatment.

There are theses in science, of course, that are abstracted from the specific phenomena and that, on the contrary, single out the general. When we say, for example, that metabolism is a necessary condition of life, that proposition holds identically at any stage of evolution. The same applies when we speak, for example, of labour as an eternal, natural condition of the life of human society, as a process that is equally common to all the social forms of life. The thesis about the fundamental nature of sensitivity belongs to this kind of proposition.

If the basic general condition of the possibility of sensation of an external influence is its correlating, environ-

ment-orienting function, this implies that, at whatever stage of the development of sensitivity, and in whatever form of psychic life we encounter a phenomenon of sensation, the given sensed influence must necessarily mediate the subject's relation to some other influence. Phenomena of sensitivity in man, consequently, also cannot be an exception in *this* respect. The fact that they have the form of phenomena of consciousness in him constitutes their specific peculiarity but that does not invalidate the fundamental relation mentioned, which characterises their nature.

Thus there remain only difficulties connected with the possibility of actually setting up the research and with choice of the appropriate material.

Our basic thesis about sensitivity requires us to consider two points: the discrepancy between simple irritability and phenomena of sensitivity, and the possibility of converting irritability into sensitivity.

There are no difficulties, of course, in regard to the first point, which is the initial premise of the research. It is easy to select agents in relation to which man exhibits irritability, i.e. in response to which we observe a definite biological reaction of the organism, but which, at the same time, do not evoke sensations in normal cases; the human organism responds to such agents, but at the same time is not sensitive to them.

The second point, which constitutes the second premise of the research, presents greater difficulties. Are there, do we observe in man, transitions that convert simple irritability into its form that we call sensitivity? Is it possible for a given agent not usually sensed by man to become an agent that evokes sensation? As extensive, scientifically established facts (almost too numerous to review) indicate, phenomena of this kind are incontrovertibly observed in man.

The phenomena fall into two classes. The first class consists of those relating to the rise of sensitivity in man to those affective agents in relation to which there is no specific, adequate receptor organ. Such, for example, are the peculiar sensations that arise in the blind. They are a 'sixth sense' that is not usually observed in people who have recently lost their sight, but whose existence has been well established by many carefully conducted experimental studies of long-standing blindness. They are also the sensations

that German psychologists call *Fernsinn* or *Ferngefühl*, that Levy called *perceptio facialis*, and that Gerhardt less specifically designated the 'X-sense'.[34]

The continuing dispute about the nature of these unique sensations of the blind does not concern the fact of their existence itself and refers only to what exactly the function of distance sensitivity to obstacles is associated with when the visual receptor has been excluded. It is not without interest, furthermore, to note here that because analysis of the facts obtained in various investigations compels us to acknowledge the persuasiveness of the, at times, conflicting data, it remains to suggest that these sensations may be built up on the basis of irritability to influences of a different order and consequently not on the basis of some one receptor but of various ones.

The same class of phenomena also includes those of the development of vibrational sensations in the deaf. From the angle of our problem the vibrational sensitivity experimentally established by Kampik in persons with normal hearing is particularly important. According to his findings, this only arises through training, and then only when reception by ear is impossible.[35]

Finally, there are data on the development of a nonspecific sensitivity in persons long engaged in certain special trades, although, it is true, they are not wholly clear and are far from scientifically confirmed; some were kindly communicated to us by S. G. Hellerstein. We shall have occasion to return to this problem later.

Another major class of phenomena, which would not at first glance seem to bear directly on our problem, consists in the well-known phenomena of the conversion of specific, but usually very subliminal stimuli into stimuli giving rise to sensation. They relate to the phenomenon of the

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[34] See: A. A. Krogius. *Psikhologiya slepykh i eye znachenie dlya obshchei psikhologii i pedagogiki* (The Psychology of the Blind and Its General Significance for General Psychology and Pedagogy), Saratov, 1926; A. A. Krogius. *Iz dushevnogo mira slepykh, chast I: protsessy, vospriyatiya u slepykh* (From the Spiritual World of the Blind, Part I: Perception Processes in the Blind), St. Petersburg, 1909; T. Heller Studien zur Blindenpsychologie. *Philosophische Studien*, 1895, *II* 226-253; P. Villey. *Le monde des aveugles* (Flammarion, Paris, 1914).

[35] See: A. Kampik. *Archiv für die gesammte Psychologie*, 1930, 1-2, pp. 3-70; see also Robert H. Hoult. Les sens vibrotacles. In: *Année psychologique*, 1934, p 3.

dynamics of adequate sensitivity and are usually interpreted either on the plane of adaptation or on that of the problem of threshold shifts during training.

Leaving aside this second class of phenomena for the time being, we can thus say that there is a type of agents in relation to which man is irritable but which do not evoke sensations in him in certain conditions; phenomena of sensation may, moreover, also arise in man in relation to these same agents.[36] The basic question is what these conditions are.

The theoretical answer that follows directly from our hipothesis is as follows: for a biologically adequate agent that does not, however, evoke sensations in normal cases to be converted into one that does evoke sensations in a subject, a situation must be created such that the given agent would mediate the subject's relation to some other external influence in it and co-ordinate him with it.

Consequently, in order to create sensations in a subject in relation to influences not usually sensed, the influence must be paired in the experiment with some other external influence. If, as a result, the appropriate sensation arises regularly, i.e. if the phenomenon proves, in fact, to be governed by the 'law of the origin of sensitivity' that follows from our general hypothesis, we can then consider that the hypothesis has found experimental confirmation for *one* link in the required chain of proof. We can, moreover, of course, expect that it will also find further development of some sort and further concretisation.

We are now left with the last preliminary question: what agent that does not evoke sensation in normal cases, but in relation to which the subject is irritable, could be used in the investigation?

In this regard our interest was drawn by the work of Poznanskaya, who experimentally studied the sensitivity of human skin to infrared rays and visible light. She found

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[36] Many papers have appeared in recent years in Western Europe and America devoted to 'extrasensory perception'. Work that assumes it possible for influences to be perceived without involvement of organs that are excitable by excitatory agents we cannot, of course, regard as scientific, although some of the facts that were presented in these papers in a mystified form doubtless have some significance in themselves. Much more interesting are the investigations into subliminal (subthreshold) stimuli, and we shall discuss them in another connection.

that, after protracted training, the skin's threshold of sensitivity to the effect of radiant energy fell in subjects, the decrease being more marked for light in the visible part of the spectrum. She concluded from this that in experiments with irradiation by visible light there is a manifestation of sensitivity to it as well as thermal sensitivity, although this only shows after training and only then for weak radiation; with strong radiation, however, sensitivity to light is entirely masked by thermal sensitivity.[37]

From the standpoint of our problem both the facts underlying this conclusion are very important: (1) the fact itself of the development of sensitivity to visible light with a heat characteristic below the threshold of the subject's own thermal sensitivity, which accords well, on the one hand, with the biological data on the existence of dermal photoreceptivity in certain animals and, on the other hand, with the fact of the excitability of non-specific neural apparatus by light,[38] (2) the significance of training noted, which also accords well, for example, with Kampik's findings in relation to the rise of vibrational sensations, already mentioned, is particularly important.

Since Poznanskaya's research, however, pursued an essentially different aim, it is still open to question whether we are dealing here with the rise of a new but inadequate sensitivity of the skin to visible light, or just a simple reduction in the thermal sensitivity threshold. The fact that this dermal sensitivity to visible light was obtained in Poznanskaya's work by a gradual lowering of the threshold of thermal sensitivity is, rather, *against* the assumption of an origination of non-adequate dermal sensitivity.

For a number of purely theoretical considerations, we assumed all the same that there was in fact a rise of new

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[37] See: N. B. Poznanskaya. Dermal Sensitivity to Infrared and Visible Rays. *Byull. eksp. bio. i med.*, 1936, II, 5: 368-369; *idem.* Dermal Sensitivity to Visible and Infrared Irradiation. *Fiziol. zh. SSSR*, 1938, *24*: 774-783. See also: N. E. Ehrenwald. Ein protodermischen Tonusreflex. *Klinische Wochenschrift*, 1933, *12*, 2: 86.

[38] Dermal photosensitivity has been established in Coelenterata by Haug (1933), Plantarii by Merker (1932), higher worms by Hess (1926), insects by Graber (1855) and Lammert (1926), molluscs by Light (1930) and others, fish by Wykes (1933), and amphibians by Pears (1910). In the present context one of the most important works is that by J. Z. Young—The Photoreceptors of Lampreys. (*J. Exper. Biol.*, 1933, *12*, 3: 229-238; 254-270).

sensitivity in Poznanskaya's experiments, and that the sensitivity of the human skin to visible light noted in them is a new kind of sensitivity created experimentally.

Our task was thus first to verify this assumption in new experiments mounted so as to exclude the possibility of factors that would mask the true meaning of the phenomena. Our first, preliminary research was conducted with this aim in view.[39]

2

Our first research into the problem of the 'functional origin' of sensitivity was aimed (1) at eliminating the element of gradual reduction of the threshold of thermal sensitivity and (2) at clarifying the relation between the forming of a conditioned motor connection on the one hand and the onset of sensitivity on the other hand. A concrete experimental procedure was devised to this end.

As the agent performing the function that we provisionally called an 'α-type influence', we used light rays in the green region of the visible spectrum, since Poznanskaya's research had shown that the lowest thresholds were obtained in this band.[40] For considerations mainly of technical convenience, the palm of the subject's right hand was selected as the area to be irradiated.

The agent—green light falling on the subject's palm—remained practically constant in its physical characteristics throughout the tests, the amount of heat rays (largely absorbed by a water filter) being quite negligible and producing an effect much below the subjects' threshold of thermal sensitivity.

As an agent serving as what we called an 'α-type influence', we used an electrodermal stimulus—an induction shock in the index finger of the subject's right hand.

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[39] This research and all that is described below (except the fourth series) was carried out in the writer's laboratory at the Moscow Institute of Psychology (1937-1940).

[40] See: N. B. Poznanskaya, I. N. Nikitsky, Kh. Yu. Kolodnaya, and T. S. Shakhnazarian. Dermal Sensitivity to Visible and Infrared Rays. *Sbornik Dokl. VI Vsesoyuz. s'ezda fiziologov* (Tbilisi, 1937), pp 307-312.

The apparatus for the experiments was mounted on two tables, the experimenter's instrument on one, the subject seated at the other. In the top of the subject's table there was a circular hole about four centimetres in diameter, over which he placed his palm; at a corresponding distance from the hole there was an ordinary telegraph key set into the table top, which supplied the electrodermal stimulus. A projector whose light was focused was fixed beneath the table, pointing upward with a water filter a little above it, then a colour filter, and finally an additional lens that focused the beam exactly on the hole in the table top. The light source was an incandescent lamp (see Fig. 1). The elec-

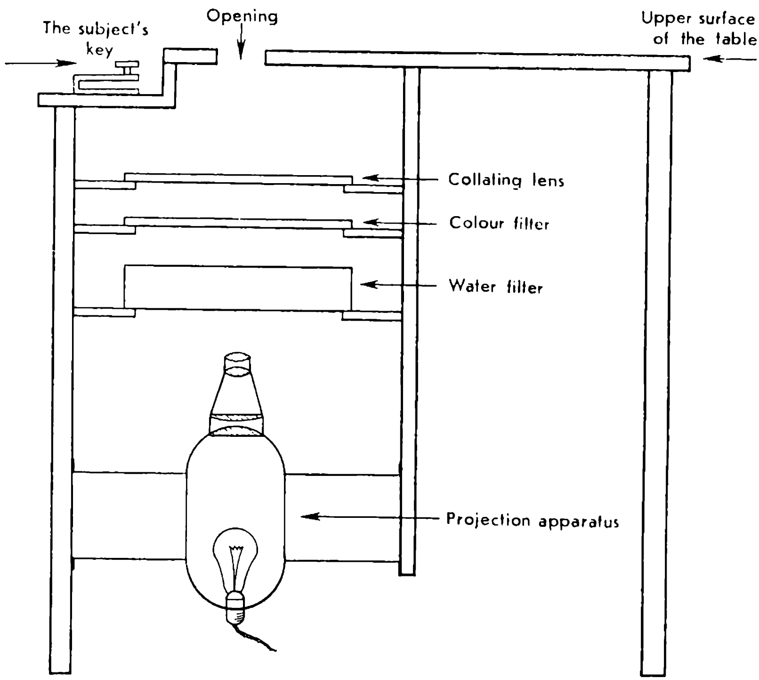

Fig. 1. Test apparatus.

trical stimulus was provided by a Du Bois-Reymond inductorium. A noiseless electrical retractable recorder marked when the experimenter switched on the light and the

subject withdrew his hand from the key. The subject was separated from the experimenter by a screen, and the laboratory was slightly dimmed during the experiments.

There were two series of tests. In the first subjects were told beforehand that they would be taking part in psychological tests on electrodermal sensitivity. When a subject entered the laboratory, the table with the main apparatus was covered by an opaque black cloth so that the hole in the table could not be seen. The subject was asked to sit down at the table, slightly sideways so that his hand naturally lay on it a little obliquely. He was then asked to turn away and close his eyes for a minute. During that time, the experimenter positioned the subject's hand appropriately, drawing his attention to the key on which he had to keep his finger, and spread some black material over his hand.

Thus all measures were taken so that the subject would not know that his hand was to be exposed to light. We called this series the 'clandestine' run.

The instructions given to the subject were to keep his finger on the key throughout the test, but on feeling an electric shock to take it away[41] by lifting his hand slightly, but to try and not move his whole arm from its place (which was due, incidentally, to its position on the table), and immediately to put his finger back on the key.

The tests themselves were conducted as follows: first light was supplied for 45 seconds by a special switch, and then immediately it was switched off, the current. In order to prevent any possibility of a conditioned reflex for time being formed, the intervals between the separate combinations were varied each time (with intervals ranging from 45 seconds to six minutes). Ten to fourteen combinations were given in a single session; in the middle of the session there was a short break to rest the subject from his stationary posture at the table. The tests were recorded in the usual way. Four subjects were tested.

This series of tests thus followed the classical scheme for conditioned motor reflexes. The light, which was to acquire the significance of an α-type influence, functioned

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[41] By this instruction, we prevented the possibility of a 'latent' motor reflex of the type established in the experiments of Beritov and Dzidzishvili (*Trud. biolog. sektora A.N Gruz. SSR*, Tbilisi, 1934).

as the conditioned stimulus, and the current (the *a*-type influence) as the unconditioned stimulus. It was our intention from the beginning to study the relation between the desired emergence of sensitivity and the formation of a conditioned reflex by tying the two processes directly together in our experiments.

It transpired that even with a large number of tests (350-400) *no motor reflex to the light's influence was formed in any one of our subjects.*

That is easily understood when we consider that the first effect in our tests (light on the skin) could not evoke any orienting reflex, i.e. it was not, simply speaking, sensed by the subject, which disturbed the normal conditions for forming a conditioned reflex. In our conditions, i.e. with simple repeated combinations, the light could not become a conditioned stimulus. As the results of this series showed, it proved, consequently, that the *basic conditions for the forming of a conditioned reflex do not coincide with those of the investigated process of the emergence of sensitivity.*

In the next, main, second series of this research the conditions were altered in accordance with our theoretical ideas about the process being studied.

The change was that we partly 'demystified' the experiment by warning our subjects that, for a few seconds before the shock the palm of their hand would be subjected to a very weak, not always immediately discernible influence and that prompt 'withdrawal' of the hand in response to it would enable them to avoid the electric shock. We thus confronted the subjects with the task of avoiding shocks and created an active 'search' situation.

Since, under this new instruction, a subject could constantly begin to try to lift his hand, we added the further stipulation that if he withdrew his hand mistakenly (i.e. in the interval between influences) he would *immediately* receive a 'warning' influence as soon as his hand was again on the key, and then an electric shock, and that he should not remove his hand this time before the shock. This additional condition had to be introduced not only for the reason given, but also, as we later became convinced, because at a certain stage of the tests it had the significance of an important additional condition for our subjects, for distinguishing the desired influence. All the other test conditions, apart from these, were the same as in the first series.

Four adult subjects also took part in this second, main series of the research.

In the end we obtained the following results. *Objectively*, by the end of the series, all subjects withdrew their hands from the key in response to the effect of visible light, some making no mistakes at all, others making occasional errors.

Subject Fr. began to lift her hand correctly after the twelfth trial (after 139 combinations), and from the 28th trial mistaken responses disappeared altogether. In the 34th test, she produced the highest results: out of a total of 18 light exposures there were seven correct withdrawals and eleven misses ('confirmed' by a shock). The general course of this subject's tests is shown in Fig. 2.

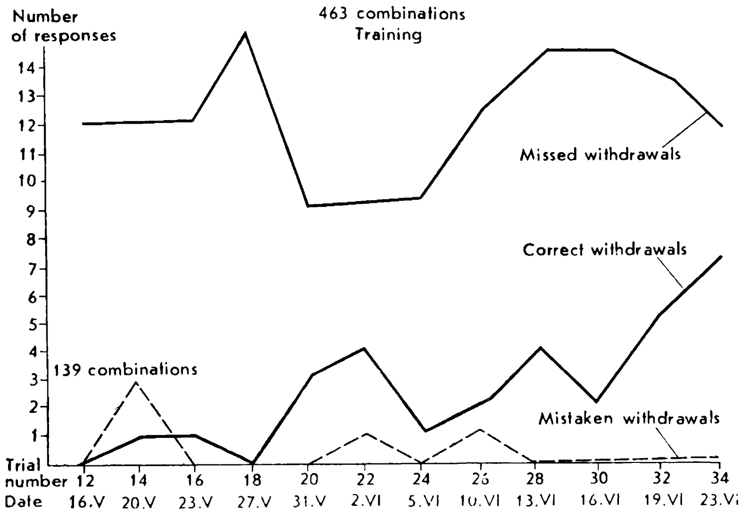

Fig. 2. Test subject Frid.

The second subject, S., had previously gone through the first series of tests, and after 300 resultless combinations was transferred to the second series. After 40 combinations in the new conditions she began to make her first correct hand withdrawals, and after 80 there were many more correct withdrawals than errors. At the end of this series, we had the following result: nine correct withdrawals, four missed stimuli, and no mistakes (see Fig. 3).

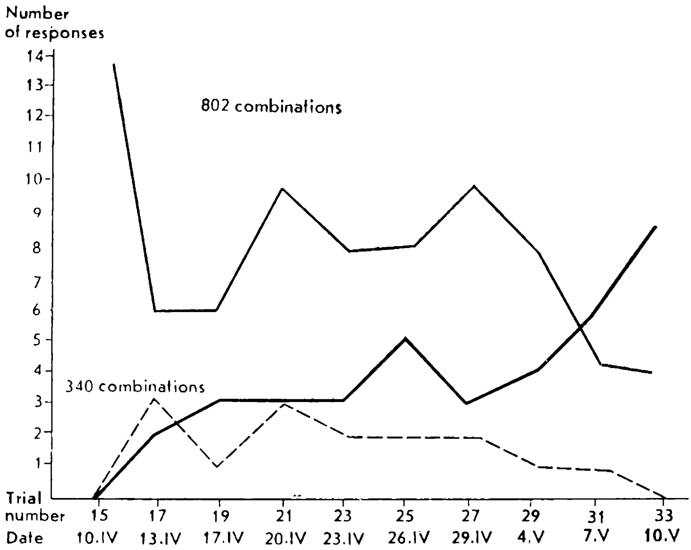

Fig. 3. Test-subject Sam.

With the third subject, G., we got the most stable results, which enabled us to use him for a large number of the control tests described below. By the ninth trial, he had already made six correct withdrawals, one mistaken one, and had missed two stimulations. Subsequently, he averaged five or six correct withdrawals, missing two or three stimulations, with mistakes varying from zero to one or two (see Fig. 4).

The fourth subject's trials were not completed owing to chance circumstances, but the data obtained after 15 or 16 runs (three or four correct reactions and one or two errors) showed that the process was the same as with the other subjects.

Considering the low probability of accidentally correct withdrawals in these conditions, it became obvious that the objective results obtained were evidence that the subjects *in fact responded to the effect of visible light on the skin of the hand.*

We can draw such a conclusion, it goes without saying, only if we assume that there were no other possible factors in the test situation that could have caused subjects' correct

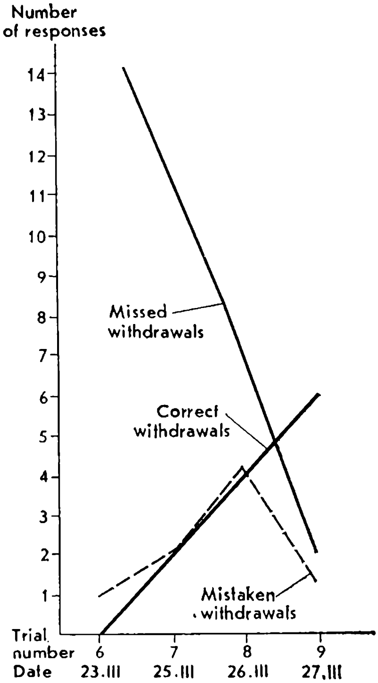

Fig. 4. Text subject Gur.

reactions. How far this assumption is justified will become clear from the reports of tests that will be described below.

Let us now turn to the *subjective* data obtained in this series.

Each time the subject raised his or her hand from the key, we asked him (her) after each run why it had been done at precisely that instant. If we dismiss the first, frankly indeterminate answers ('simply because, it somehow seemed...'), and very contradictory answers in situations when withdrawal was still in most cases mistaken, the testimony of all the subjects in this and other series carried out later, gave the impression that a non-specific experience was being described. The only difference was in the way the subjects described this experience.

Here are some of these descriptions: 'I felt a blowing on my palm', 'it was as if my hand had been lightly brushed by a bird's wing' (just the same testimony was obtained in Poznanskaya's experiments cited above), 'a slight vibration', 'it was as if I had touched something...', 'like a breeze', and so on.

In order to give a fuller impression of the testimony of our subjects, we quote from the detailed minutes of one of the conversations (subject K., a first-year student in the faculty of mechanics and mathematics).

'Under what conditions did you lift your hand?'—'When there was marked freshness, then that was wrong, and warmth was also wrong. It was correct when something like a wave passed over my hand; only waves are separate as

it were, but this goes on continuously. If there is a break that is something different'—'But is this sensation associated with a sensation of warmth?'—'No, there is no sensation of warmth. Once I thought: perhaps there should be heat? When I thought that, it seemed to me it really was warm. I was then myself surprised that I felt warmth. But that turned out to be wrong.'—'Was it a distinct sensation you experienced before the shock?'—'Now it's quite distinct. When I'm in doubt, I check this way: I lift my hand, if it doesn's stop, it means it's correct'.—'Perhaps you should have had a trial before the test?'—'I sometimes check myself: I feel that I wait for the shock—will there be one or not?'

All the subjects mentioned the difficulty of expressing these sensations in words, their instability, and their very low intensity. The sensations often merged with other sensations in the hand, which progressively increased in number as the trial got longer (numbing of the hand?). The main difficulty was just how to single out the required sensation from the whole range of other, extraneous sensations, cases of mistaken withdrawal and its following 'hint' helped, when the subject knew that his hand was under the relevant influence at that moment. 'Therefore,' one of our subjects said, 'I sometimes lifted my hand simply to refresh my memory, to catch the sensation again.'

Many subjects (we are relying now on their testimony taken in all the series) noted at the end of a series a strong associative and perseverant tendency in these sensations. It was sometimes enough to position the subject's hand on the apparatus for the sensation to appear, even before the experimenter had signalled that the test was to begin, i.e. the sensation arose even when the subject was sure it could not do so. In those cases we heard subjects ask the experimenter to wait until 'my hand has settled down'. 'Devils are dancing right on my palm,' one subject complained. The perseverant tendency stands out just as clearly: 'It is dangerous to lift a second time when you've guessed right. Sometimes it works, but in general it is harder; you may feel it again soon—wrong again' (subject K.).

A typical feature revealed in the tests is the pronounced increase in the affectivity of the experimental situation itself for most of the subjects—errors were often experienced very negatively; the subjects seemed to be affectively

involved in the job of avoiding an electric shock (although the objective strength of the electric stimulus never exceeded the minimum sufficient to cause a reflex jerk of the finger; for our equipment's circuit it corresponded to 5-8 cm on the scale of a big Zimmerman sledge with maximum coil and a 4-volt power supply for the primary winding and a completely inserted core). This affective relation to the shock sharply distinguished the behaviour of the subjects of the second series from those of the first. It also seemed to be related to the rather paradoxical fact that sensations arising at very *low intensity* proved, however, *to have great affective strength*, which was especially clear when (in a second experiment) we asked already trained subjects not to lift their hand from the key at all during exposure. The subjects' affective relation toward the task given them in experiments is, it seems, an important factor; we judge that from the fact that it was just those of our subjects who had an especially pronounced affective relation to the task who also produced the most pronounced positive objective results.

The main conclusion, from the angle of our main problem, stemming from the objective observations and the subjective testimony, is that *subjects' correct reactions to the effect of light on the skin of the hand are only possible when the subject is oriented on the sensations arising within him.* Only one of our subjects, who had undergone very many tests, mentioned that sometimes his hand lifted 'as if of its own accord'. With all the other subjects, as soon as their attention was distracted, correct reactions either became impossible altogether or their number was greatly reduced. The need to pay attention to their own sensations called for great effort from subjects; any kind of unfavourable circumstance, like indisposition, fatigue, distracting experiences, and so on, usually always had an adverse effect on the objective results of the experiment.

At the end of a test series, we tried to change subjects over to a key with a pneumatic chamber (of the type of Luria's key for recording conjugate motor reactions). But the kymograph recording did not yield any changes that would correspond to an incipient involuntary hand movement in response to the light's influence.

We are inclined to stress these facts because it follows from them—still only provisionally, of course—that sen-

sitivity to a given agent does not emerge after the formation of a conditioned reflex, but rather that the sensitivity arising is one of the external conditions for the possibility of a conditioned reflex to the influence concerned being formed.

This means that a state that is subjectively expressed as a vague non-specific sensation is not simply an epiphenomenon superimposed on conditioned reflex processes and constituting a 'parallel' phenomenon with them, in itself lacking any objective role whatsoever.

The facts that we would specially stress are that a necessary condition for the rise of the studied sensations is the presence of a certain directed activity of the subject, which in our experiments has a peculiar form of inner, 'theoretical' search activity, possible only in man.

The objective experimental data that we obtained already in the first preliminary investigation are quantitatively quite clear and firm. Admittedly not one subject achieved 100 per cent correct withdrawals of the hand in response to the effect of exposure, but that does not in the least, of course, vitiate the significance of the data, especially when we take the other relevant factors noted above into account, viz., the low intensity of the sensations, their high perseverant tendency, the difficulty of singling them out from other, chance sensations, and so on.

The main question remained, namely that of the real factor determining the possibility of correct responses by subjects, in other words the question of qualifying the main fact of the experiment.

Clarification of this point called for a radical change in the technical conditions of the experiment, which involved the use of much more complicated apparatus. We were therefore compelled to leave it open until the next, new experiment, and to proceed provisionally on the assumption that it would be answered positively. From that angle, we carried out a third, small series of tests with the same experimental set-up, which consisted of tests that were at once 'exploratory' in character and controls. For these trials we used the subjects who had produced the most stable results in the second series.

The experiment consisted in our replacing the green filter by a red one, without warning, at the very end of the

investigation (after 750 tests with S. and 500 with G.). The results obtained were the following:

S.: seven correct withdrawals and no mistakes, with the green filter; the next day, with the red filter, two correct withdrawals and one mistake; on the third day, with the red filter, one correct withdrawal and one mistake;

G.: with the green filter, five correct withdrawals, no mistakes; the next day, with the red filter, five correct withdrawals and one mistake; on the next three runs, carried out a week later, after other control experiments, again using the red filter, the number of positive responses was lower.

Such were the objective results. Let us now turn to the subjective data.

S.: in the very first run with the red filter, after a second excitation (both missed), she said: 'Why do I feel it so poorly, or can't I concentrate now? I'll try now'. After the third excitation, also missed: 'I felt it, but very weakly, I'm trying to concentrate, but it's not working. I don't quite know why.' On the fourth excitation, she withdrew her hand, commenting: 'It's very difficult to catch, it used to be easier.' Then she made a mistaken withdrawal.

G.: (first trial with the red filter): first excitation missed; after the second also missed, he remarked: 'There's a sensation, but of another character—in a sharper vibration.' The third and fourth excitations were again missed; after the fourth he said: 'I wanted to say then that there was one'. There was no response to the fifth, but to the remaining five correct withdrawals. After the run he said: 'There was something different, then I just adapted.'

This prompted us to try giving this subject, after a time, some tests in differentiating red and green filters without any preliminary training ('off the cuff'). As a result, he missed three stimulations, made three correct withdrawals, and one error, though admittedly getting the stimulations the other way round, i.e. the usual one (green filter) was 'different, new', and the new one (red filter) was 'normal'.

What do these trials mean? Apparently, it is the light beam itself that essentially governs our subjects' reactions. The fact of substituting a different filter for the usual one, while maintaining the other conditions of the experiment, could only affect the result (1) by changing the frequency of the light flux and (2) by raising its thermal effect. Thus,

on the one hand, we obtained certain indirect confirmation that we were, in fact, dealing with sensitivity of the skin to visible light in these conditions; on the other hand, the trials faced us with the problem of making the phenomenon studied more precise.

The next experiments were carried out without a light filter at all, which was also done, of course, without warning the subjects.

As a result S. did not once lift her hand correctly, made only one mistake, and missed nine stimulations. G. had one correct response, four mistakes, and four missed stimulations. The subjective testimony of the two was rather different. S. limited herself, as in the tests with the substituted filter, to remarks that 'nothing worked' for her, and so on; G., after the single correct reaction, said: 'The sensation is intense but different', and finally spoke directly of the action of heat.

These experiments thus yielded results similar to those of the tests with a changed light filter but only more pronounced. The difference between the subjects was also maintained: in both trials G. observed a finer distinction of effect, and analysed them more exactly; hence, probably, also the difference in the objective results.

During supplementary experiments with S., we disconnected the lamp altogether, for control purposes, so that the whole experiment was in fact 'idle'; typically, in spite of the fact that the absence of a stimulus before the shock clearly contradicted the subject's whole preceding laboratory testing, and ran counter to her expectation, she did not make a single attempt to lift her finger from the key in this experiment. 'I felt nothing,' she remarked with surprise after the run.

In conclusion we set up an experiment with subject G. in which, instead of the usual effect of visible light on the palm of his *right* hand, we operated on the palm of his *left* hand. The results obtained were the following: tests with the right—six correct reactions, three missed stimulations, one mistake; tests on the same day with the left hand—three correct reactions, seven missed stimulations, and one mistake. On the next two experimental days we obtained the following with the left hand respectively: four correct reactions, seven misses, no mistakes; and six correct reactions, six misses, and no mistakes. Switching

over again to the right hand, we get seven correct reactions, two misses, and one mistake. The fact of a switch of skin sensitivity to visible light from the right hand to the left in this subject was thus beyond doubt.

These tentative, exploratory experiments of the last series are quite inadequate, of course, for us to draw any kind of reliable conclusion from them. Experiments combining the content of the second and third experiments, which continued the initial cycle, were devoted to developing the phenomenon interesting us further.

3

Our second investigation into the origin of dermal photosensitivity was carried out jointly with Poznanskaya. S.J. Rubinstein also took part, conducting several independent series of trials.

The first objective we set ourselves was to confirm the main phenomenon, i.e. dermal photosensitivity, more carefully, and to qualify it. We had to ensure the highest possible rigour in the experiments, excluding possible extraneous influences on the subjects from the test situation. For that purpose we had to allow for a more exact characteristic of the main influences by means of appropriate physical measurements. Finally, we had to provide a possibility of modifying the procedure and instituting special control tests.

To that end we rebuilt the set-up. The subject's equipment was put in a separate laboratory wired to the experimenter's room along the corridor. That completely isolated the subject from possible influences directly from the experimenter.

The 'table' at which the subject was seated during the tests was fitted out as follows: the central box had two, low, wholly enclosed wings at each side, in which two movable light sources with condensers and 750 W projection lamps were mounted on wooden rails; between them and the central box were water filters (with a 15 cm layer of liquid), movable, stands for colour filters and supplementary lenses (see Fig. 5).

Below the central box, on a level with the beams from the two projectors a mirror prism was so set that the two beams

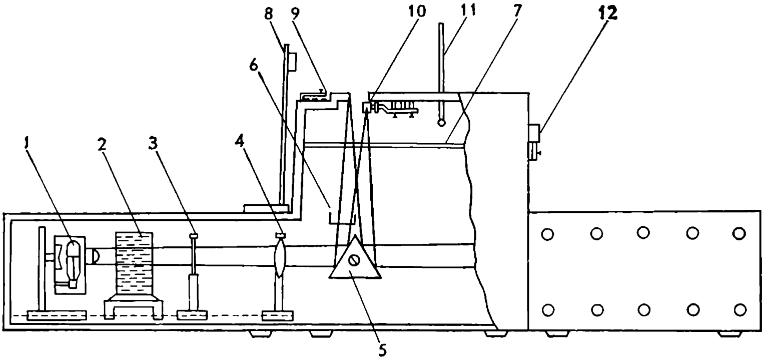

Fig. 5. Cross-section of the subject's apparatus: 1 — illuminator lamp; 2 — water filter; 3 — colour filter; 4 — auxiliary lens; 5 — reflecting prism; 6 — auxiliary water filter; 7 — glass barrier; 8 — signal lamp; 9 — the subjects's key; 10 — electrode; 11 — thermometer; 12 — assistance signal device.

were reflected upwards and focused evenly over the opening in its table-top over which the subject's palm was to be placed. Above the prism, there was another, 6-centimetre, horizontal water filter, and a thick sheet of plate glass, which blocked any flow of air into the space directly adjoining the opening.

This type of table for the subject, built as an optical bench, made it possible (1) to employ two sources of radiant energy and (2) to regulate the illuminative and thermal effect quite accurately, both by varying the distance of the energy source and by changing the filters absorbing heat rays (either by pouring water into additional filters, or by replacing the water with solutions having a higher coefficient of absorption).

The raised box was lifted, as in our first investigation, with an adjustable key to supply electric stimuli, set into the top. Another small opening was cut in the same edge of the table into which one element of a sensitive thermocouple was inserted (the other element was placed in a Dewar flask in the same room) which made it possible to record small temperature changes in the skin directly adjoining the illuminated surface. A detachable non-polarised electrode was spring-mounted front centre on a narrow rocking lever to study the skin's electric potential and resist-

ance; another electrode, for the subject's left hand, was fixed on a separate support.

The laboratory was also equipped with an electric thermometer to measure the general variation of the subject's skin temperature during the trials and with mercury lab thermometers to measure the room temperature and the air temperature in the part of the apparatus directly communicating with the opening in the table-top.

Directly in front of the subject there was a signal lamp on special stand. Behind it was a signalling instrument to link the experimenter and his assistant, which was screened from subject by the box. The laboratory was also fitted with a device to measure visual acuity, a special illuminator with a rheostat and voltmeter (not shown in the figure), and another lamp that was switched on from the experimenter's room; the purpose of these instruments will be explained below. The general arrangement of the experimental set-up in the laboratory where the subject was seated is shown in Fig. 6.

The apparatus in the experimenter's laboratory was accommodated on a big table and an adjoining wall. It consisted of several items, as follows (see Fig. 7):

1. *instruments for delivering stimuli*:

   (a) a knife switch to the city electricity mains; a rheostat and A.C. voltmeter to control the constancy of the voltage in the projector lamp circuit; a main contact switch for the lamp circuit and a knife switch for changing from one lamp to the other, and a noiseless mercury circuit-breaker (not shown on the diagram) in parallel with the main switch;

   (b) a Du Bois-Reymond inductorium, switch and key for delivering electric stimuli;

   (c) a switch for the lamp of the extra light source (visual stimulus);

2. *signalling instruments*:

   a signal button to the subject; a signalling device connected with the main switch, for communicating with the assistant; a signalling switch (for control tests); a signal lamp from the subject's key and a signal lamp from the assistant;

3. *instruments recording the skin temperature of the subject's hand*:

   a coupling block for the line of the thermocouple; the

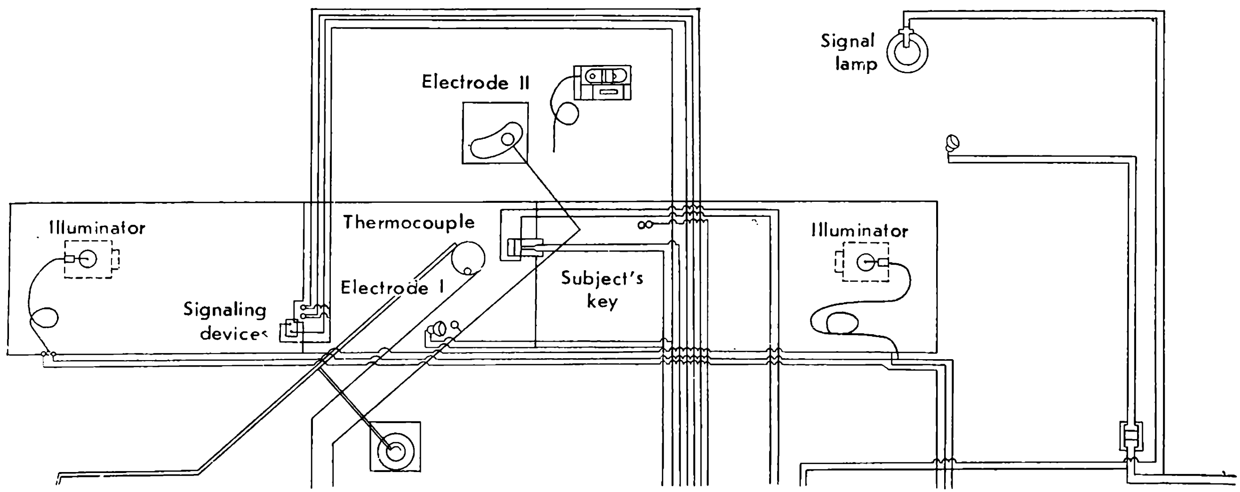

Fig. 6. Test layout I (for subject).

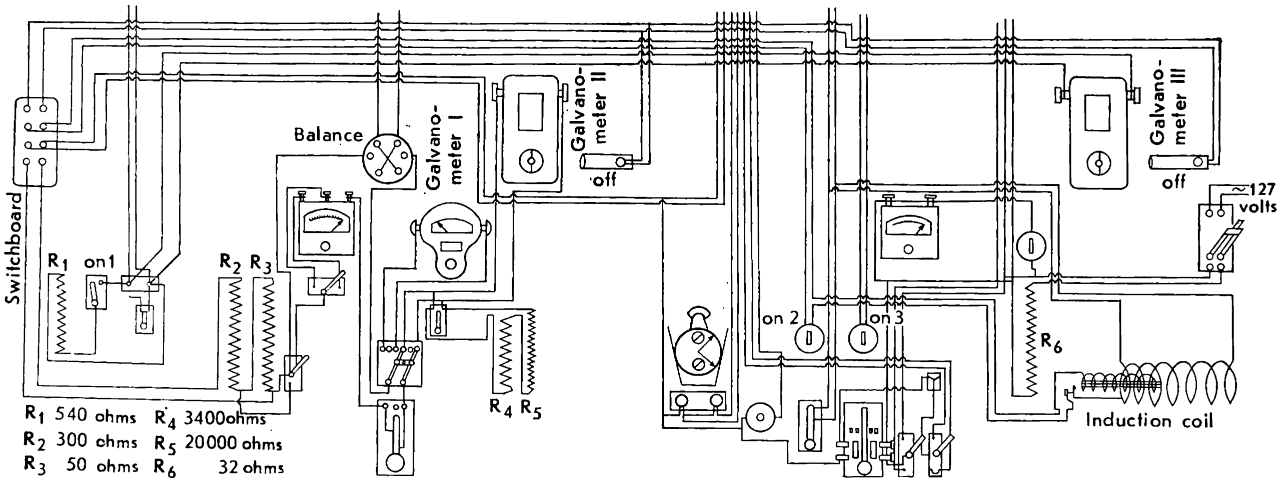

Fig. 7. Test layout II (for experimenter).

contact switch for this line and a rheostat and decade box (not shown on the diagram); and a mirror galvanometer (III);

4. *instruments for studying the electric potential, resistance and electric sensitivity of the skin* (combined lay-out):
mirror galvanometer (II); moving-magnet needle galvanometer (I); D.C. millivoltmeter with a double scale; field switch, rheostats and potentiometers; a circuit changeover switch and key for working with one of the three possible lay-outs.

The tests in the first series of this experiment were conducted in the same way, in principle, as the second series of the previous work. The sole differences between them were as follows. (1) Illumination of the palm was cut to 30 seconds, while the intervals between stimuli were correspondingly reduced, and now lasted from 30 seconds to three minutes. (2) Communication between subject experimenter was by electric signals. The subject was warned that the test was about to start by a short flash in his signal lamp; a flash lasting several seconds after lifting of the finger signified a correct withdrawal, and a flickering light a mistake. When the subject lifted his finger from the key, the signal light on the experimenter's table automatically went out. The assistant in the subject's laboratory could receive instructions by code signals on another lamp not visible to the subject. (3) Practice runs were supervised by an assistant sitting behind the subject and to one side, who recorded the latter's behaviour and watched the equipment. A faint signal (green or red according to the light source used) lit up on the assistant's panel (again not visible to the subject) at the same time as a stimulus was transmitted. This part of the signalling system was switched off in all control tests.

The whole first series (three subjects) was carried out with quite constant stimuli; their brightness, as measured, was around 3/4 stilb, i.e. considerably higher than in our first experiment. The thermal characteristic, measured by a calorimeter, was, however, minute—0.006 small calories.

The experimental data obtained in this series of tests confirmed the results of the first investigation.

The typical course of the emergence of sensitivity in one of the subjects of this series is illustrated in Fig. 8.

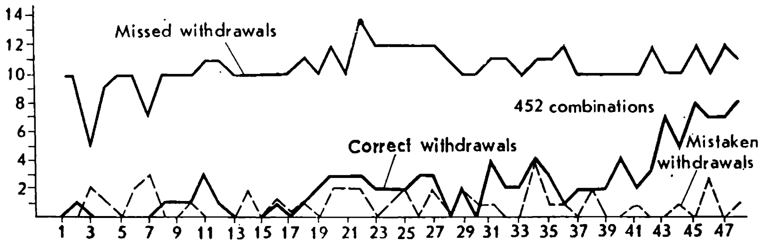

Fig. 8. Test subject K., series A.

As an example of the course of the experiment we include the record for one of the last tests with this same subject (Table 1).

Table 1

Subject: K.		Date: 2 June 1939			Series No. 47	
Stimulus No.	Time of transmission of stimulus	Internal between stimuli	Errors	Correct removal of hand	Length of stimulus (seconds)	Shock transmitted
1	15.51'00"			+	27"	
2	54'30"	3'00"				+
3	56'00"	1'00"		+	20"	
4	58'30"	2'00"		+	26"	
5	59'30"	0'30"				+
	Break		none			
	16.05'30"					
6	08'00"					+
7	09'30"	1'00"		+	29"	
8	11'30"	1'30"		+	19"	
9	12'30"	0'30"		+	20"	
10	15'00"	2'00"				+
11	21'30"	1'00"				+
12	23'30"	1'30"		+	21"	

Notes: Experimenter—Leontyev; assistant—Rubinstein; present—Prof. M. S. Lebedinsky. Signalling system switched off.

The probability of extraneous factors influencing the results was now minimised by the test conditions. Subjects were completely isolated from the experimenter so that any involuntary signals from the latter were eliminated. The

isolation of the control lamps also completely precluded such effects from the assistant. Finally, going over to a mercury vacuum switch made the sole technical operation, coincident with transmission of the main excitation, quite noiseless. It remained to exclude effects connected with the action of the light beam itself.

The question of the possible role of heat also remained of prime importance. The figure of 0.006 small calories, that we obtained on well-tuned instruments (we used two different calorimeters) was, of course, very much less than the threshold of thermal sensitivity, but it remained to clarify whether this threshold varied in our subjects during the tests themselves. For that purpose, we measured their sensitivity thresholds to infra-red rays at the very end of the series. The values obtained, as was to be expected, were much higher (by a factor of ten) than those involved in our tests (0.06-0.04 small calories). The possibility of a subject's reacting directly to heat rays was thus excluded.

It could, however, be assumed that the radiation had an indirect thermal effect arising from conversion of the energy of visible light. Special measurements were made to ascertain this.

We assumed that if heating did in fact occur, it must necessarily affect that part of the skin directly adjoining the irradiated part. In order to detect this it was sufficient to record the temperature of the skin nearest the irradiated area systematically throughout the tests. A special thermocouple was mounted in the apparatus for this purpose, one element of which was pressed by a spring against the edge of the subject's palm being irradiated. The scale of the mirror galvanometer (300 mm long, and divided into 0.5 mm units) covered a temperature gradient around 1.2°C, so that we were able to detect changes with an accuracy around 0.005°C.

Measurements were made at different radiations intensities (in small calories). Since considerable variations of skin temperature occurred during a trial, average values for the half-minute intervals of illumination and for the intervals without exposure were compared. They showed (1) that for an intensity between 0.10 and 0.16 small calories, there was a slight but regular rise in skin temperature; (2) that with an intensity between 0.006 and 0.10 small calories there was apparently no thermal reaction; and (3) that

with an intensity of 0.006 small calories (the value used in our experiments) there was undoubtedly no thermal reaction.

The influence of the skin's thermal reaction thus proved to be completely excluded. That can be stated with particular confidence because the data obtained were compared with the general variations in skin temperature that we obtained by systematic measurements with a cutaneous electrothermometer before, in the middle, and at the end of the test. The measurements were taken at two points: in the middle of the palm, on the exposed portion, and on an adjoining part. They showed (1) that very considerable variations (up to 1°C) occurred in the skin's temperature during the test; (2) that the highest value occurred at the start of the test, and the lowest in the middle and at the end; and (3) that there were no noticeable essential differences in the variation of temperature between the exposed part of the skin and the adjoining part. The data thus indicated that the observed variations of skin temperature were independent of the effect of the light, or that in any case the effect was completely masked by the influence of other factors. The decrease in skin temperature, for example, appeared to be connected with the fact that the subject's hand was stationary and pressed tightly against the surface of the table throughout the test.

The next problem that faced us in this series, and which we tried to answer, was whether convection heating possibly played some role.

The lighting of a lamp, even momentarily, inevitably heated the metal grids around it, and despite ventilation heated the air in the apparatus, especially that in the upper part, cut off by glass, which was in direct contact with the palm of the hand. It was conceivable that changes in the air temperature of the set-up might affect subjects' reactions; and although this seemed improbable, because of the relatively slow spread of convectional heat which, given the unevenness of the exposure would necessarily have produced an exceptionally complex pattern of temperature variations, we made special measurements just the same.

It turned out that the air temperature at the top of the apparatus rose by roughly 3°C during the experiment (from the readings of more than 30 checks). This was a very important fact. With such marked variations in air temperature around the irradiated palm, it was unlikely that the

subject would react to the relatively quite insignificant radiant heat of the light beam. On the other hand, the data indicated that the subject's observed skin-temperature variations did not depend on external thermal influences (or, rather that their effect was completely masked), since the temperature gradients for the skin and the air in the apparatus were in opposite directions—the first fell while the second rose steeply.

To trace the dependence of the temperature variations of the air in contact with the subject's palm on the switching on of the light sources, we took readings (to within 0.1°C) at half-minute intervals for 50 minutes, in the course of which there were 22 exposures. The results of these measurements are plotted on the graph in Fig. 9.

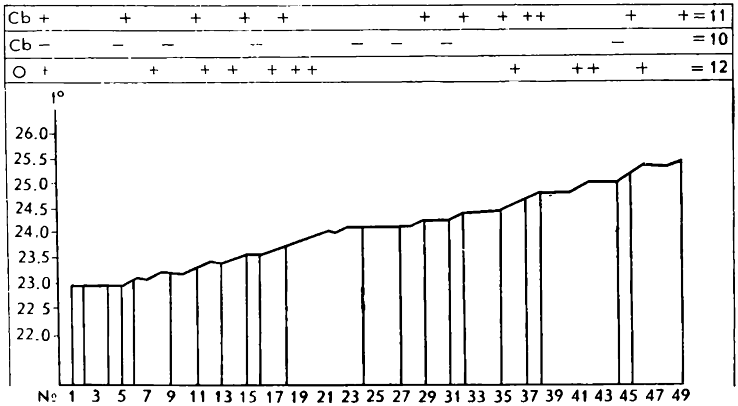

Fig. 9. Curve showing air temperature rise in apparatus.

The Y-coordinates corresponding to half-minutes of exposure are drawn by heavy vertical lines on this graph, the ordinates of the intervals between exposures are not shown. Eleven cases when the switching on of the light sources coincided with a temperature rise are plotted on the curve, ten cases when the switching on did not coincide with a temperature rise, and twelve cases when a rise occurred without previous switching on of the lamps. The possibility that subjects oriented themselves on a rise in air temperature

in the apparatus was consequently excluded in the conditions of our experiments.

As part of this series we also studied the effect of irradiation on the changes in electric potential and resistance of the exposed part of the skin.

Poznanskaya's earlier experiments had shown that, with prolonged, sufficiently strong thermal irradiation the skin's electrical resistivity fell steeply and a positive charge collected on the heated part. It therefore seemed advisable to investigate these two characteristics in the conditions of our experiment both on subjects who had gone through previous trials, and on subjects without such experience.

The data on the effect of radiation on resistivity indicated that with irradiation of 0.1 small calories or more there was a slight change in both classes of subject, which caused a slight increase in current strength, but at the level of 0.006 small calories (Q) the reaction was within the limits of error and did not have a regular character.

Similar data were obtained from investigating electric potential of the skin.[12] No variations were detected at 0.006 small calories either in the main group of subjects or in the controls.

The variations in the intervals between the onset of the light beam's action and the subject's response of lifting his finger from the key were specially examined. Considerable fluctuations around low average values were observed at the start of the series; by the end, however, they evened out in all subjects, though not to the same extent, and, moreover, increased. With subject K., for example, whose reaction time was the most stable by the end of the series (we use the term, of course, in a provisory way), interval lengths for his last 120 correct responses were distributed as follows: the first 30 responses had average reaction time of 16 seconds, the next 30 of 19 seconds, a third 30 of 20 seconds, and the last 30 of 25 seconds. The average variation was 6.3, 6.0, 5.0, and 2.6 seconds respectively. The last figure clearly shows the impossibility of even a few correct responses occurring by chance by the end of the test series, since an accuracy of 2.6 seconds with an average interval of two minutes

[12] The fact of a change in the e.m.f. of the skin of a frog in response to radiation was checked in our laboratory by L. T. Zagorulko and A. V. Lebedinsky. They obtained positive results with an intact nervous system (*Fiziol. zhurn. SSSR*, 1932, *18*, 5: 711-712).

between exposures gives an extremely small probability of chance withdrawals.

It was rather surprising at first glance that all our subjects' reaction times did not decrease during the tests, but on the contrary markedly increased. Subjects' comments themselves provided the explanation. Since their main difficulty was singling out the required sensation from other faint sensations and perseverations, which is best done by tracing their dynamics, they gradually developed a special tactic on the one hand for retarding their response and on the other hand formed a habit of estimating the interval (always the same in our tests) between the beginning of exposure and the electric shock. In fact, looking through the records, it is apparent that after a missed exposure the subjects shortened the response time slightly and then increased it again. Subject K. (test sheet 48), for example, lifted his hand the first time at 27 seconds, the second time at 28 seconds, and missed the third exposure, remarking: 'I didn't manage get it off'; at the next exposure there was a correct withdrawal in 21 seconds, then one in 29 seconds. The next exposure was missed, but that was followed by two correct withdrawals in 25 and 26 seconds.

When we felt the main objective of this series had been met in general we decided, as we had done in the third series of the first experiment, to set up the final control tests excluding the effect of light. Understandably, these tests could only be carried out at the very end of the experiment and not by any means with all the subjects, since they would necessarily create an emotional break, which would be the stronger the more the test situation affected the subject. In fact, one of our subjects, after the first imaginary exposures which were followed by shocks, refused outright to continue, pleading that 'today she could not concentrate', and that 'her hand was sweating'. We then obtained fuller results with another subject of this series.

Unlike the similar trials in the first investigation, we did not disconnect the line to the light sources, but switched them on as usual; unknown to the subject, however, we laid a small, but thick, book on the glass cutting off the top of the apparatus, exactly in the path of the light beam.[43]

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[43] Suggested by P. P. Blonsky.

No changes other than that could thus occur in the test conditions.

We made two trials using this method, each consisting of two parts: in the first the test conditions were normal, but in the second part the beam was screened by the book. A total of eight exposures was made, the intervals between them being the same in both halves of the trials. The results were as follows: 12 correct responses, four misses, no errors in the first part; two correct responses (one at 53 seconds, which happened because the cut-out switch did not work properly during this exposure), 13 misses, and one error in the second part (subject K; text records 66 and 67). The results, of course, need no comment.

4

To sum up: the first series of this second investigation we can take to have established with a quite high probability that subjects' thermal threshold remained significantly higher than the thermal effect of the light source, i.e. that the sensations experienced by them during the tests were not directly caused by radiant heat but were apparently due to the effect precisely of the light beam. It would be possible, and quite natural, however, to suppose that there was a radiant-heat effect *in connection* with that of the light, assuming a catalytic effect of the latter on thermal sensitivity, which would thus be raised by illumination of the skin.

If that were the case, our experimental data would only allow us to speak of a lowering of the threshold of thermal sensitivity and not at all of an emergent specific dermal photosensitivity. Our next job was thus to assess this possibility experimentally.

We felt this problem also deserved attention from a rather different angle. The usual interpretation of certain phenomena of sensitivity as the result simply of a quantitative process of lowering the threshold was far from theoretically satisfactory to us. In fact, after discussion of the modality of dermal sensitivity and the discovery of protopathic sensitivity, it was not unreasonable to suppose that there was a qualitative change of experience in connection with a similar qualitative, objective change in the process itself. It seemed to us that there must be a certain discontinuity

in a number of cases of gradual quantitative reduction of threshold, expressed in a rise of new objective correlations. The problem that arose during our investigation allowed us to make some progress toward throwing light on this more general problem.

The second series of our research was thus to make an experimental study of the relation (in our test conditions) between thermal sensitivity and excitability as regards visible light.

Our main technique this time was a return to the method of gradually reducing the intensity of the illumination, as Poznanskaya had done in her experiments. We had at the same time to distinguish between the effect of the two factors. In other words we had to have the chance to arbitrarily alter the degree of exposure of our subjects during the tests, on the one hand, and the amount of heat radiated, on the other hand. For that purpose we devised a threshold reduction schedule in twelve stages, using a two-section set-up with movable light sources and interchangeable water filters, that provided for a divergence of the illumination curve from that of the radiant heat.

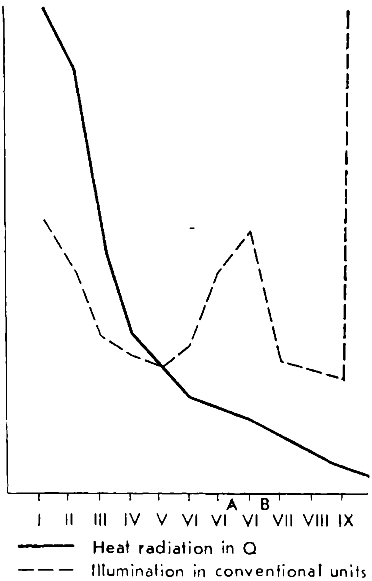

Fig. 10.

Stages I, II, III, IV, VII, VIII, and IX represented a series of decreasing values of both illumination and radiant heat; in stages V, VI, VI^A and VI^B, these values diverged sharply through an increase in illumination. The last stage (N), which corresponded to the excitation of the first series, gave the maximum divergence (see Fig. 10). The subjects, of course, were not informed of these changes of excitation during the tests.

We also conducted this series with three subjects; we should now consider their results separately.

For the first trials with subject R. we used the method of the first series of keeping the effect constant (stage N). Like the other subjects of this series R. made occasional correct withdrawals in the first 14 trials, made twice as many mistakes, and missed more than 90 per cent of the exposures. In her comments, she remarked: 'I feel nothing in my palm, there is no sensation', 'there is something, but it is vague', and so on. After the 15th trial she was transferred to the second series.

We began with the second stage in our schedule. The subject made three correct withdrawals in succession and was transferred on the same day to stage III (0.102 small calories); on the third day we gave her excitation IV (0.064 small calories). Four days later when she began to respond correctly, we tried to transfer her to stage V, but were forced to revert to IV, as she was successful only at the ninth trial. Here the figure for the change in her threshold of thermal sensitivity was 0.045 small calories, i.e. a much lower value. This correlation was paradoxical; nevertheless, we also observed it in other subjects. We tried at first to explain it by the fact that the thermal threshold was being measured by open devices, free from the disadvantage of our closed apparatus, in which variations of convection could conceivably affect the subject's hand and so disturb him; at the end of the investigation we began to lean toward another explanation, which we shall discuss below.

The subject's testimony was quite definite. She said at the beginning, 'I distinctly feel heat.' Only at stage IV, for the first time in the tests, did she add once: 'And it seems to be from something rough.'

The 13th trial produced satisfactory results with exposure V (0.049 small calories), so we moved on to the second part of the trial with exposure VI (0.034 small calories), i.e. we *reduced* thermal intensity by 30 per cent and at the same time *increased* illumination by 70 per cent. The objective result was positive. Subjectively, to the experimenter's question: 'What did you feel when you took away your hand in the first part of the trial?', she replied: 'At first I felt heat, then a sort of touch.' To the same question in relation to the second half of the test she replied: 'The same, only the sensations seemed stronger' (report 14).

The next trial after this critical experiment was made with exposure VI (0.036 small calories) and much lower

illumination; the subject produced her first satisfactory result only at the 25th test, i.e. after ten days of training. Her testimony at the last run with this stimulus was typical: 'I feel heat. Now it's different than before ... a sort of touch ... such a light touching' (report 25).

Stage VII comprised seven runs, stage VIII, three, and stage IX only two, i.e. there was a significant quickening of training at the end of the series, as at the beginning. Thus, when we analyse the course of the tests, remembering that the later stages differed considerably from the middle ones in the radiant heat of the stimuli though they were almost equal in luminescence, it becomes obvious that in the first part of the series, the 'training' process depended on the radiant heat curve, while after the critical stages (V and VI), it depended on the illumination. In other words, *at the beginning of the series the subject's reactions were determined by thermal sensitivity, but in the second part by sensitivity to light.*

This conclusion was completely confirmed by a second critical experiment, which consisted in moving the subject from stage IX to stage N, which (remember) corresponded to the constant conditions of the first series and differed from the preceding stage in a further sharp reduction in radiant heat (0.011—0.006 small calories) and at the same time in its even steeper increase (several times greater) in illumination. If the subject's reactions were determined, as previously, by the thermal effect, moving her to this new stage should lower the number of correct responses. If our conclusion was correct, however, i.e. that the subject was now oriented to illumination and not to heat, it should not be difficult to switch to stimulus N.

The first test after the run with exposure IX, made with a normal exposure, yielded the following results: six correct withdrawals, four misses, and one mistake; the second run gave eight correct responses, four misses, and one mistake. (The results of the next runs are shown in Fig. 11.)

Let us consider the subject's evidence after the first run with stimulus N. Experimenter: 'In what conditions did you remove your hand?' Subject: 'When my hand was clammy, then it would dry, when it was not clammy, then I seemed to feel a light touch, and then an ever so gentle breeze. Earlier, a month ago, the sensation was different, sharper. Sometimes I could feel it at once.'

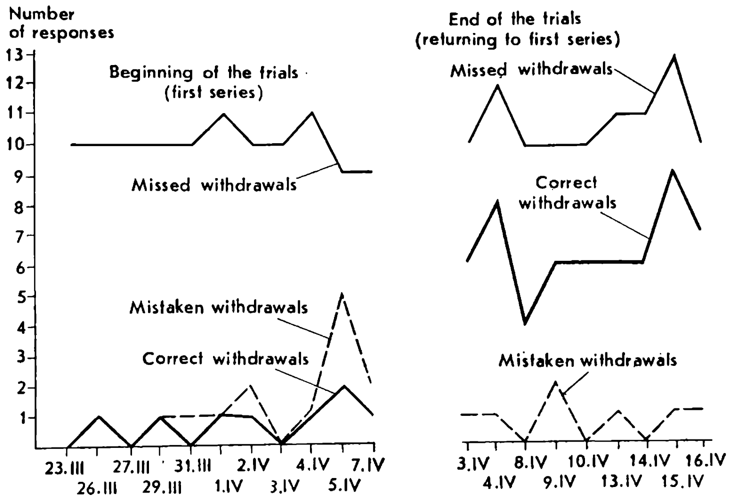

Fig. II. First series, test subject R.

The second subject, Mikh., was also given a preliminary run through the tests with the stimulus N (first series). The results after 12 tests were: six correct withdrawals, 22 mistaken responses, and 112 misses. From the 13th run, the experiments were carried out with stimuli of the second series.

He went through stage II on the first attempt (a flying start), but stimulus III required eight days' training, even though his threshold of thermal sensitivity was almost half the level of the heat received (as was the case with R.). Mikh. passed to stage IV (0.064 small calories) in three trials; stage V (0.049 small calories, a value close to the threshold) appeared to be the most difficult one for both Mikh. and R. The first satisfactory results with this excitation were obtained only at the 11th trial, after which we immediately went on to the critical experiments.

The purpose of the critical experiments with Mikh was primarily to obtain, in the region of maximum divergence of the curves of our schedule, a possibly sharper expression of the dependence of his reactions on the correlation of the factors interesting us. For that reason, we employed, for the first time, the technique of reverting to preceding stimuli (of 'alternating' stimuli).

In the next test after the run with stimulus V we used stimulus VI in the first part and stimulus VI^A in the second. The results were as follows: in the first part (0.037 small calories with illumination of 24 lumens), was one correct withdrawal, seven misses, and four mistakes; in the second part (0.034 small calories with illumination of 36 lumens) there were five correct withdrawals, five misses and two mistakes.

Thus, as with R., we obtained more positive responses and fewer errors when we reduced the thermal effect and increased illumination (reports 24 and 25).

Repeating the experiment with stimulus VI^A produced even higher indices, i.e. six correct withdrawals, four misses and one mistake. We then reverted to VI, and got one correct withdrawal, 11 misses, and two mistakes. The subject conseqently reacted to the increased thermal effect and lowered illumination by *reducing* the number of correct withdrawals and *increasing* the number of mistakes.

We repeated the experiment a third time, with two more runs with stimulus VI, which produced even clearer results. We then made another trial with stimulus VI^A. This time the subject made five correct withdrawals and no mistakes (report 30). Repeating the tests thus not only did not wipe out the difference noted but, on the contrary, emphasised it even more, from which it follows that the increase in the subject's sensitivity to the effect of high illumination has a negative rather than a positive influence on his sensitivity to the effect of a greater amount of radiant heat and of lower illumination.

On the basis of the data obtained, however, another conclusion might be drawn. Since the change back from stimulus VI^A to VI not only reduced illumination but also increased radiant heat somewhat, we might attribute the poorer results to the latter, i.e. assume that the thermal radiation had a negative effect. In order to check that, we carried out a fourth control trial with slightly reduced illumination and thermal effect reduced considerably to 0.023 small calories (stimulus VII). The results obtained were negative, i.e. three correct withdrawals, nine misses and four mistakes. The next trial with simultaneously increased illumination and heat (stimulus VI^B—0.029 small calories) again gave clear positive results (report 32.) The findings of this experiment thus militated against the above-mentioned possibil-

ity and instead confirmed the opposite, i.e. that the light beam tended to reduce the subject's sensitivity to thermal radiation.

This point came out particularly sharply with our third subject, Muz. Before describing these trials, however, let us note Mikh.'s introspective testimony. To the experimenter's question: 'What did you feel before you lifted your hand?', he replied at the end of the tests just described: 'A sensation of heat. But the sensation of heat remains uneven. Sometimes it was a very clear sensation, but on another day it was very doubtful whether there was heat or not. Today it was doubtful. I did not feel it sharply, and sometimes I withdrew my hand, sometimes did not' (report 32). Let us recall that the subjects were not warned of the change of stimulus: in the test to which this subject referred, he made five correct withdrawals, without a single mistake.

Now let us turn to the experiments with Muz., who passed to the second series at the 13th run, having begun straight off at stage II. Having gone rapidly through the next two stages (III and IV) in four days, he was transferred to the critical stage V on the sixth run. As later measurements showed, his threshold of thermal sensitivity was between 0.06 and 0.05 small calories, i.e. approximately corresponded to the heat radiated by stimulus V (0.049 small calories).

The first trial with this stimulus yielded hopeful results—four correct responses and no mistakes. The results of the next one were also positive on the whole—six correct responses and two mistakes. The third trial produced lower results—three correct and two mistaken responses (which we were inclined to attribute to chance.) The fourth run again yielded satisfactory results—five correct and two mistaken responses. These five correct withdrawals all came in a row in response to the last five stimuli. Although that warranted passing on to the next stage, we decided, as a further check, to continue the experiments with the same critical stimulus V.

The fifth run again produced satisfactory results—the highest of all, i.e. seven correct responses, only three misses, and not one mistake.

In subsequent trials, however, the number of positive reactions again fell off sharply. In the sixth, we had only two correct withdrawals of the hand, and in the seventh three correct withdrawals and three mistakes. The eighth experiment again yielded very high results—seven correct

responses and no mistakes. And then, in the ninth, tenth, and eleventh trials, we again had stable negative results.

It did not seem possible to explain such variations by chance factors. Considering the findings with other subjects, we were therefore inclined to attribute them to the critical nature of the stimulus itself and so tentatively explain them by an antagonistic effect of visible and thermal radiation.

We accordingly tried to shift the process by alternating the effect of stimuli with a higher degree of illumination and a lower thermal effect. The expected shift did, in fact, occur and in a very pronounced form.

The first experiment with stimulus VI^B yielded negative results. Reversion to stimulus V (the 13th and 14th trials stage of the series) at first produced unsatisfactory results, then rather better ones.

The second experiment with stimulus VI^B, with a return first to stimulus VI and then to V, sharply reduced the number of positive responses: three correct withdrawals and four mistakes, then no correct response, then two correct ones and two mistakes; finally, one correct withdrawal and one mistake.

The third experiment with stimulus VI^B, upon reversion to stimulus V yielded no correct responses whatsoever ('I don't feel anything', the subject said). which compelled us to revert to stimulus IV the same day. The result was one correct response. (It will be remembered that this subject had immediately made six positive responses and not a single mistake at the beginning of the series at this stimulus.) The same day we went back yet another stage to stimulus III. The result was not one correct response in five tests. Only at stage II did we again obtain positive results: four correct responses and no errors in the first trial, and nine correct responses and one error in the next trial (reports 32 and 33).

The stage of stimulus II was an initial one that had not required preliminary training for any of our subjects. Judging from their testimony, they had all reacted to quite pronounced thermal sensations in the trials with this stimulus. An even greater reduction of our subject's sensitivity therefore seemed improbable; nevertheless we continued the experiment with alternating stimuli.

As a result we got a *further reduction of sensitivity*: the 36th trial at stimulus II produced five correct responses

and two mistakes; the 37th trial gave two correct and two incorrect responses; the 38th gave six correct and three incorrect ones; the 39th test again produced only one correct response and one mistake. In the last trial, for control purposes, we intensified the thermal effect steeply, switching unnoticed to maximum intensity; from the first stimulus the subject got five out of five possible responses correct. His sensitivity to exposure to mixed radiation had thus become much lower at the end of the series than it had been at the start (the tests lasted about $2^1/_2$ months).

Was this explainable by a general lowering of the skin's sensitivity, perhaps even one that set in independently of the course of our experiments? Or did we have a specific phenomenon here? The next two tests were carried out with infra-red rays. They yielded quite normal results: error-free responses to a stimulus of 0.058 small calories, and then after a little practice of 0.053 small calories. Tests with smaller amounts produced negative results. Repetition of the tests after that with stimulus II produced five correct responses and one mistake, then four correct responses and no mistakes (reports 42 and 43). At that point the experiments were stopped.

There were thus fixed complex functional correlations of some sort underlying the marked lowering of sensitivity, which could be quite hypothetically described as the result of light's coming to have an inhibiting effect on thermal sensitivity.

Comparison and analysis of the experimental findings of this second series of our investigation thus enabled us to draw the following conclusions.

(1) The sensations arising in our subjects were not the result of any lowering of the threshold of sensitivity (which, on the contrary, tended to rise) but were specifically linked with the action of the light beam.

(2) The increase in sensitivity in the tests with a gradual lowering of the intensity of the radiation was the result of a qualitatively new process that set in at a certain critical stage (the true threshold of thermal sensitivity) and that corresponded to an objectively different quality (aspect) of the affective stimulus. The new subjective quality of sensation arising in the subjects was therefore not in any way independent of a change in the quality of the objective influence but was rather an adequate reflection of this change.

Rubinstein carried out a short special series of tests. Their purpose was to check in improved experimental conditions whether subjects could possibly differentiate the light beams used in our first preliminary investigation.

A slightly altered procedure was used for this third series. In the first practice runs the subject received a warning signal every two minutes, after which the experimenter directly sent the usual stimulus for 30 seconds, or else skipped a whole interval until the next signal. The subject's task, as in the previous trials, was to respond to the sensation by removing his hand from the key. The following alternatives were thus available: (1) the subject would respond to the presence of light (positive correct response); (2) he would remove his hand if though there was no stimulus (mistaken response); (3) he would not remove his hand when there was no stimulus (negative correct response); (4) he would not remove his hand when there was a stimulus (missed excitation).

For this series we also took three subjects, a new one and two who had been through the first series.

As the findings showed the subjects immediately produced clear positive results in these new conditions. Subject K. provided the following data (Table 2).

It was especially marked in these tests that the total number of mistaken responses proved negligible—only eight cases, which was an average of less than 4 per cent.

The results of another subject were: correct responses—72 per cent, mistakes—12 per cent. The third subject, who had been through the first series of tests, showed the usual 'training' pattern, i.e. results were close to the calculated probability in the first 15 experiments, and then the correct response curve began to rise slowly. The time factor, however, prevented these trials being completed and this subject could not do the main ones.

Let us now turn to description of the main (critical) trials of this series. The same procedure was followed as in the practice tests, the sole difference being that the subjects were warned that either a red light or a green one would be used and that they were to learn to distinguish between them. In both cases, the stimuli were associated in the usual way with a shock. Some of the experiments were done

Table 2. Results of Testing Subject K.

Report number	Total number of intervals	Number of mistakes	Number of correct responses	
			in absolute figures	as a percentage
49/1	20	—	15	75
50/2	20	5	10	50
52/3	18	—	14	78
54/4	9	—	7	78
56/5	14	—	10	71
59/7	20	1	14	70
68/8	11	1	14	88
61/11	21	—	18	86
62/13	18	—	14	80
63/14	19	1	16	84
64/15	15	—	13	87
65/16	15	—	13	87

in parallel with practice ones, and some after them.

To exclude any difference in thermal effect the new stimulus was adjusted to normal by pouring fluid into the extra filter. In that way we managed to eliminate noticeable fluctuations of the needle of a sensitive galvanometer linked to a microthermopile (e.m.f. per 0.001°C=75 microvolts), fixed opposite the opening in the top of the test apparatus, when we switched quickly from one light source to the other.

Let us first consider the data obtained in the experiments with the first subject. At the beginning, he was given a few trials with each colour and was informed each time immediately afterward which colour it was. The record of the first control test is given in Table 3.

The results column shows seven correct differentiations, three misses, and no mistakes.

A second, quite similar control trial produced less satisfactory results: five correct differentiations, two misses and three mistakes (13 April 1939, No. 56/6).

After this trial, the subject did seven runs of practice tests with both stimuli separately, and then a third control trial in which he had to choose between three possibilities: red light, green light, or no light at all (report 62/12, control). The findings were extremely significant; in the total of 22 intervals, seven were without stimulation, eight with

Table 3. Tests with Subject K. (9 June 1939)
(Report No. 54/4 control)

Stimulus number	Time of transmission of stimulus	Colour of light	Result	Duration of stimulus (seconds)	Shock	Subject's comment
1	33′00″	green	+	29″		green
2	34′30″	red	+	28″		red
3	36′00″	red	+	25″		red
4	37′30″	green	+	28″		green, I responded correctly
5	39′30″	green	+	29″		green
6	42′30″	red	+	28″		green feels nicer, but I feel this poorly, therefore, red
7	44′00″	red	—		+	I don't know
8	45′30″	green	+	28″		green
9	47′00″	green	—		+	I don't know
10	48″30″	red	—		+	I don't know

green light and seven with red one. The results of the choice between stimulation and no stimulation were: 18 correct, three misses, one mistake. On making this single mistake, the subject remarked: 'It is red, I think, since it is very weak'. The results of distinguishing between stimuli were: out of a total of 12 responses (15 minus three misses), seven were correct, two were refusals to choose and two were mistakes. One response was not clear because after correctly indicating 'red', the subject went on to say (during a green light): 'there is something but not that'. If that is regarded as an instance of correct differentiation (i.e. if the subject's words are taken to mean: 'Yes, but not red') the total of correct differentiations rises to eight.

Similar results were obtained with the second subject. Nine of the 21 intervals in the final experiment were without stimulation, five were green and seven were red. The results of the differentiation of exposures were as follows:

total number of responses 11 (12 minus one miss); six correct, three refusals, and two misses (16 April 1939, No. 65/6 control).

The summer vacation prevented our continuing the tests with the third subject, as noted above. It would have been inexpedient to continue them later, since the data obtained from the first two subjects, we considered, were sufficient for us to try and employ differentiation as the main technique in the experiments of another (fourth) investigation. Their further verification was therefore made a side result of separate research being carried out in another laboratory.

So as not to return specially to the problem of distinguishing between the influence of light of different parts of the visible spectrum, we note here that in the fourth investigation subjects had to differentiate from the start between red and violet light in conditions of complete 'secrecy' even of the general nature of the affective stimuli. As the results obtained showed, differentiation did in fact occur.

Because, in this investigation, as in the tests of the series just completed, the exposures were balanced only as regards radiant heat, and considering the results of the second series regarding the role of illumination in arousing sensation, on the one hand, and the self-observations of our subjects ('I think it is red because it is very weak'; 'Red passes off quietly'), on the other hand, which above all emphasise the quantitative difference between the experiences, it can be assumed that the difference in degree of illumination, rather than in the frequency of the flux, plays the main role in differentiating between exposures. A special investigation would be needed to assess how far this assumption was justified, but the lack of importance of this special point for our main problem did not seem to us to justify the difficulties of precise polychromatic luxmetering and, especially, of balancing the stimuli for both thermal effect and light intensity. We therefore confined ourselves to establishing that it is possible to differentiate the light affecting the skin, without setting ourselves the task of analysing and qualifying the fact itself any further.

Before proceeding to an exposition of our third investigation, we will try to recapitulate certain results.

The main objective of both the investigations was to establish experimentally the basic fact that sensitivity does

arise in the skin to the influence of visible light not normally sensed by it.

The complete impossibility of subjects' reacting in the experimental conditions to changes in radiant or convectional heat, the traced dependence of the emerging sensations on the objective correlations characterising the affective flux of radiant energy, and finally, the data of the control tests aimed at isolating the role precisely of the studied agent, all permitted us to regard the rise of photosensitivity as established, though still needing further verification.

The relatively small number of subjects who could be taken through the separate series of tests owing to the great complexity and length of each cycle, which required 70 to 90 'experimental' days, was largely offset by the reciprocal overlap of the data obtained during the whole work. The total number of subjects (not counting those of Poznanskaya's study), for example, in whom the fact of skin sensitivity to light was established, albeit with different degrees of clarity, was 16. Tests with five subjects were unsuccessful for one reason or another.

But what were the sensations that arose in our subjects as a result of the tests? Their features can be summarised as follows.

1) They were of very low intensity, unstable, highly perseverant and as we have had occasion to observe, they vanished quite quickly after a cycle of tests was stopped.

(2) They were undoubtedly very intimately linked with affective experiences and apparently in spite of their low intensity, had considerable excitatory force.

(3) Finally, the sensations arising usually did not have the character of discriminative-gnostic sensitivity. Our subjects' subjective descriptions seemed to refer to the product of a secondary process leading to chance experiences of 'waves', 'oscillations', and so forth. We are therefore inclined to regard such indications of subjects as 'there's nothing definite, though there is undoubtedly some kind of irritation' (subject A.), 'I can't describe this sensation; it's nothing (subject V.), and so on, as those corresponding most directly to the quality of the sensations themselves. That is indicated by the qualitative shift in these sensations that occurred in certain conditions depending on an adequate dermal sensation correlative with them. This shift is reminiscent of the change of sensation observed, for exam-

ple, by Head in regard to the phenomenon of protopathic sensitivity. We shall return to this point again when analysing the results of the fourth investigation.

The nature of the phenomena of sensitivity that we studied remains a serious question. When discussing it we can start from two different assumptions.

First of all we can start from the assumption that a new form of sensitivity has arisen in the subjects in the course of our tests and that we are thus creating an experimental analogue of the genesis of sensitivity proper. Alternatively, we can start from another assumption; we can take the view that the sensations observed in our test subjects are the result of stimulation in the skin receptors of an inherent, phylogenetically ancient photosensitivity that has been suppressed or inhibited in normal conditions by the evolution of higher receptor apparatus. From that angle it must be recognised that we did not observe the true *emerging* of a new form of sensitivity in the course of our tests, but only the *detecting* of an existing photosensitivity arising in consequence of excluding any possibility of visual perception and sharply reducing the radiant heat effect that is usually associated with visible light of high intensity. This assumption is fully substantiated, on the one hand, by the fact of dermal photosensitivity established in phylogenetic succession, and on the other hand by the assumption, undoubtedly correct *in its general form*, that the origin of new organs and functions is linked with the suppression or 'hiding' of phylogenetically older functions, but that these functions can be detected again if the possibility of the new masking processes making themselves felt can in some way be inhibited (Orbeli).

How is this assumption about the nature of the dermal photosensitivity found in our subjects related to the main hypothesis of our investigation? Clearly, if we start from it, then we will have to modify the way we posed the problem slightly.

Our initial postulate was formulated in this way: it follows from our interpretation of sensitivity as a special form of irritability, i.e. as irritability to influences that *mediate* realisation of the organism's fundamental vital relations, that for an influence to which man is irritable, but which does not arouse sensation in him, to be converted into one that is sensed by him, the influence must begin

to perform the function of mediating and orienting the organism in relation to some other influence. Hence, to check this initial fundamental postulate, the function of an influence ordinarily unperceivable has to be altered in an experiment, and it has to be ascertained whether, in fact, the subjects become sensitive to it owing to the experimental conditions. From the standpoint of the second assumption, the matter has to be posed differently, as follows: if sensitivity to a particular influence is suppressed because, with the evolution of higher, more perfected apparatuses, it has lost its previous inherent function of mediating the organism's connections with other excitatory properties of the environment, *then to restore the organism's sensitivity to this influence it is necessary to revive the mediating function that it has lost.*

Our main experimental technique was to eliminate artificially every possibility of the organism's relation to a second effect (shock), mediated by the effect (light) being studied, as required by the conditions of the experiment, being established by normal sensory paths (vision, temperature, sensation); by influencing the skin's surface apparatus irritable to light by a light beam we at the same time shifted the whole process to this apparatus, as it were, thereby actually restoring its sensitivity to light.

It is thus immaterial for our conclusions which assumption we start from since, from the angle of the fundamental hypothesis of the investigation the main point is *whether, in the given test conditions, influences that are not usually sensed are converted into sensed influences.* The question of whether new sensitivity has emerged or whether a phylogenetically ancient sensitivity has been restored is a relatively secondary matter.

From theoretical considerations that it would be premature to develop now, incidentally, we are rather inclined to assume that a new form of sensitivity has been experimentally created. How far that is correct we can only finally judge by using a form of excitation as the mediating influence that does not occur in natural conditions, e.g. rays generated only by artificial means.

The next question arising in the discussion of our results is that of the physiological mechanism of this dermal photosensitivity. It is not our business to consider this matter specially; therefore, we limit ourselves to a few comments only.

From the physiological angle the possibility of a change in the receptor function of the dermal surface in our subjects may apparently be satisfactorily explained if we pay attention to the fact that as a general rule the effect of excitation is not only determined by properties of the particular influence, but also depends on the state of the receptor system itself. We can thus, in principle, attribute the observed changes to the influence of centrifugal accessory innervation on the skin's receptor apparatus (Orbeli).

A second factor which we think needs to be considered is the variability of the 'level' of processes moving away from the periphery. Hypothetically, we can imagine that a process arising at the periphery under the influence of light (previously limited to functions of a specifically trophic action) is heightened, figuratively speaking, i.e. gets a representation in the cortex, which is also expressed in a rise of sensations. In other words, it is hypothetically possible to conceive the change taking place by analogy with a process leading to the rise of sensations coming from interceptors that usually do not produce sensations.

The last point in this regard is the question of the involvement of receptors. Although histological study has revealed a whole number of terminal apparatuses in the skin, among which tactile, heat, cold, and pain receptors have been identified, their division is still in a certain sense arbitrary since their functions are by no means mutually independent. We can thus assume the following three possibilities: (a) the observed sensitivity may not, in general, be associated with any specialised cutaneous receptors; (b) on the contrary, it may be linked with restoration of a function of a histologically described apparatus that used to be specialised in this respect but has been lost in the course of evolution; (c) on the other hand, it may be associated with the non-specific participation of a whole set of receptors. Thus, for example, it seems probable that the *localisation* of the emerging sensations depends on tactile receptors (the pressure of the hand over the aperture in the table).

All these comments are, incidentally, we repeat, quite preliminary and are only intended to show that it is possible in principle to bring out a physiological aspect of the process being investigated.

Finally, two major inter-related problems that confront-

ed us from the start, remained almost untouched in the research carried out. One is the problem of sensitivity and the conditioned reflex, the other is the problem of the specific situation which creates the conditions needed for sensations to arise.

An initial approach to both these problems was the task of the next (the third and fourth) investigations.

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Outwardly our experiments were constructed along the lines of those with conditioned motor reflexes. We tried to produce a defensive motor reaction in each subject, normally evoked by the effect of an electric shock in response to a hitherto indifferent agent. The conditions for obtaining this reaction (again outwardly) themselves coincided with those for forming a conditioned reflex: the same indifferent agent preceding an unconditioned stimulus in time, and the same repetition of combinations.

In these tests, however, there was also something different from classical experiments in conditioned-reflex formation. This difference lay in the special nature of the indifferent agent.

'Conditioned stimuli,' Pavlov said, 'can be produced by any natural agent for which an organism simply has a receptor apparatus.' 'Here,' he said, 'the limit is determined by the perfection and fineness of the receptor apparatuses'.[44] But how is one able to assess the work of these apparatuses themselves? 'Any fluctuation in an animal's environment,' we read, 'even when it does not involve special (innate or acquired) responses, will in general produce an orienting reaction, an investigatory reflex. It is this reflex that can, above all, serve for ascertaining to what degree an animal's nervous system is different from that of an other animal.'[45]

The purpose of our work, on the contrary, was to produce a defence reaction of the subject, as a result of the ex-

[44] I. P. Pavlov. Lectures on the Work of the Cerebral Hemispheres. Lecture 3. *Pol. sobr. soch.*, Vol. 4, 2nd ed. (Izd-vo AN SSSR, Moscow-Leningrad, 1951), pp 52-53.
[45] *Ibid.*, Lecture 7, p 124.

periment, to an agent that had not previously been capable of producing either a special or an orienting reflex. In these conditions could one expect a defensive conditioned reflex to arise? We did not expect it, although we began our investigation by trying to get one. The relevant experiments, it will be recalled, produced negative results, as with other workers.

That was not the idea behind our tests. In our conditions, naturally, the task of producing a conditioned reflex could only be the next, second step. It was necessary to convert a stimulus that did not usually evoke any orientation into a 'distinguishable' one, i.e. into one that could evoke an orienting reflex (we can also say: one that could convert a normally unsensed influence into a sensed one).

Outwardly the conditions of the tests may seem to coincide with those of both problems, which could correspondingly look as if they expressed two aspects of a basically single process. From that angle the change that we introduced into the experiment may seem inessential; nevertheless, as our results show, it was this change of conditions that proved decisive.

We must postpone analysis of these special conditions of the experiment until we discuss the results of the fourth and final investigation. Meanwhile, limiting ourselves to studying their actual role, we must pass on to a review of the process we studied.

Is a conditioned reflex actually formed in our tests? Does the preliminary process, corresponding to the first task, differ qualitatively from the process corresponding to the second problem?

Our investigations had not specially pursued the aim of differentiating between the emergence of sensitivity and the forming of conditioned-reflex associations; and to do that our method proved unsatisfactory. We had to make new tests using a special technique.

The main drawback of our previous method from this aspect was that the subject's reaction could be both a simple, purely reflex response to stimulation, and voluntary, i.e. a very complexly conditioned process. Even the quite clear change in the character of the reaction that we had noted in a few relatively rare cases, occurring at the end of a series of tests ('I lifted my hand involuntarily', 'I did not even notice that I lifted it') could not serve as grounds

for any kind of definite conclusions. It was necessary to separate these two processes and so eliminate the alternatives created by the procedure of our experiments.

This could only be done in one possible way; namely, by introducing a second, easily recordable reaction that would be involuntary and quite beyond the subject's control. We resolved the problem by employing the results of research into 'sensory conditioned reflexes', the possibility and main patterns of whose formation had been demonstrated almost simultaneously by Bogoslovsky, Dolin, and Kekcheyev.[46]

These workers had established that the sensitivity of man's sense organs can change through the forming of what they called 'intersensor conditioned connections'. To establish these it was necessary to combine some particular agent indifferent to the sensory function being investigated several times with a stimulus that directly altered this function, i.e. it was necessary to create the same conditions as for forming motor or secretory conditioned reflexes.

More detailed study of sensory conditioned reflexes has shown that the laws of their formation are in no way essentially different from those of ordinary conditioned reflexes. They can thus be quite justifiably regarded as processes that quite adequately represent the cortex's conditioned-reflex activity in general. In addition, the enormous advantage of sensory conditioned reflexes over motor reflexes from a certain angle is that in research on man a change of a sense organ's function is a process usually independent of direct influence from higher processes. Its advantage over the technique of secretory reflexes, which are extremely complicated to study in man, in spite of the invention of capsules of all kinds, etc., is also obvious.

By introducing a change of sensory function into our experiments as a second, indicatory process, we were able to study the formation of a conditioned reflex in a situation in which the results obtained were truly involuntary and

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[46] See: A. I. Bogoslovsky. An Experiment in Inducing Sensory Conditioned Reflexes. *Fiziol. zhur. SSSR*, 1936, *20*, 6: 1017; A. O. Dolin. New Facts on the Physiological Understanding of Association in Man. *Arkh. biol. nauk*, 1936, *42*, 1/2 301; G. Kh. Kekcheyev and O. A. Matyushenko. Influence of Sensory Stimulation on the Sensitivity of Peripheral Vision. (Communication I). *Byull. eksp. biol. i med.*, 1936, 2, 5/6: 358-360; and later papers by them.

uncontrolled. The validity of our experiments was enhanced by the fact that the subjects knew nothing of the reason for making the supplementary measurements, which in no way differed from any of the others (temperature, etc.), which were continually encountered during our experiments.

We selected change in visual acuity as the sensory process to be studied.[47] The unconditioned stimulus was an increase in the lighting of the laboratory, while the indifferent agent was the beam of light on the skin of the hand. The tests were made with the same apparatus as in the second investigation, except, however, that an additional device was used to measure visual acuity by exposing Landolt rings (in a mirror), and that a source of constant light was introduced in the form of a set of low-voltage bulbs covered by a frosted globe, with a rheostat and voltmeter in the circuit to monitor the voltage. This lighting system was needed in the laboratory so as to exclude any fluctuations of illuminance that might occur if the bulbs were fed from the mains, i.e. from the same source as the big lamps of our projectors. A booster lamp was also used, whose switching on immediately after the indifferent stimulus served as the unconditioned stimulus. The laboratory was darkened, of course, and all the tests were carried out under artificial light.

We began this third investigation[48] with the following basic test on K., who had already gone through the first and third series of the second investigation and who had produced very clear results in both series. While continuing the tests by the method of the third series, we complicated them by introducing a second recorded function, namely, a change in visual acuity. The test sequence was as follows: at the beginning, after the subject had become adapted to the lighting conditions, his visual acuity was measured, first in these constant conditions, then with increased illumination (from the booster lamp). The measurements, like those that followed, did not require any change of position of the subject in the laboratory, and were made while he was seated at the apparatus. Then the subject received a

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[47] See: A. I. Bogoslovsky. Conditioned-Reflex Change in the Discriminative Sensitivity of the Eye to Brightness. *Byull. eksp. biol. i med.*, 1939, *8*, 3-4: 272; Idem. Art. cit.; and other papers by him.

[48] V. I. Drobantseva took part in the investigation. We consulted A. I. Bogoslovsky systematically throughout.

warning signal, after which--in those cases when his hand was exposed to the light beam—additional illumination was provided as the unconditioned stimulus (90 seconds). After a short test (four minutes on average) the subject was again warned, and so on.

In the practice runs, i.e. in the tests that were all reinforced, around 160 combined stimuli were given. This large number, which was many times more than was required to form sensory conditioned reflexes in Bogoslovsky's experiments, was due (1) to the intervals between excitations being much shorter in our tests, which had an unfavourable effect on the results, and (2) to the conditions for forming a conditioned reflex themselves being very complicated in our case.

After these practice runs, we passed on to the conditioned reflex trials proper, which differed from the usual ones in that, in some instances, we interrupted the effect of the excitation on the subject for 25 seconds, requesting him to look at the projected Landolt rings and thereupon noting his threshold of visual acuity. For control purposes, we also made the measurements after 'idle' intervals. The results showed that a sensory conditioned reflex to the effect of light on the skin of the hand was formed.

The details of the last test (No. 65/16a) are given in Table 4.

Table 4

Number of stimulus	Time of transmission of stimulus	Reaction	Reinforcement	Visual acuity
1	15.50'00"	+	used	
2	55'00"	+	used	
3	16.00'00"	+	used	
4	03'00"	—		
5	04'30"	—		
6	06'30"	+	not used	13
7	12'00"	+	used	
8	15'00"	+	used	
9	19'00"	—		
10	23'00"	+	not used	12
11	30'00"	+	used	
12	34'00"	+	used	
13	37'00"	—		
14	42'00"	—		10
15	48'00"	+	not used	12

We thus got the following results.

Visual acuity before the test: nine standard units with normal illumination, 13 with increased illumination.

Visual acuity during the test after exposure of the skin was 13-12-12; after the signal, but without exposure—ten.

In order to be able to interpret these results somehow, we had first to ascertain whether a sensory conditioned reflex to the effect of light on the palm could also be formed in subjects who had not previously gone through long special tests cultivating skin sensitivity.

Since all our efforts in the direction produced a negative result, we naturally had to conclude, tentatively, (1) that imperceptible influence of light on the skin, which is incapable of bringing about a voluntary motor response in the subject, could not become a conditioned stimulus for such a response and (2) that, on being converted into an influence that could be sensed by the subject, and so capable of evolving a voluntary response, it could also become a conditioned stimulus.

Hence the main problem to be studied now became whether things were such that a special, specific process took place first, as a result of which sensitivity was formed in the subject to a previously imperceptible influence as the precondition for the subsequent forming of conditioned-reflex connections, or whether the two were essentially one and the same process, i.e. whether the training of sensitivity is nothing other than the gradual forming of conditioned connections.

This problem proved most difficult to resolve experimentally. To find the general methological principle was simple: obviously, in order to prove that two processes did not coincide with each other chronologically, it was sufficient to connect them sequentially in an experiment. In practice that would have meant that we had to start forming the conditioned reflex and cultivating dermal photosensitivity at the same time and to carry out both processes in parallel in one and the same experiment. But meeting this requirement in an actual procedure came up against innumerable difficulties, and a whole year's work with 14 subjects was needed to draw the first conclusions.

We again resorted to the method used in the first series of the second investigation, but this time we combined the sensitivity tests with trials to form a sensory condi-

tioned reflex. In some cases the unconditioned stimulus was a double influence—an electric current plus a change of illumination; in other cases there was only the change of illumination. The first method had the disadvantage that by combining the two techniques mechanically, it produced a very complex picture of the process that did not lend itself easily to analysis. The second method, as it turned out, had another, major disadvantage: it was difficult to create an active state in the subjects; they often 'dropped out' of the experiment (in the psychological sense), i.e. they were distracted from the task of establishing the presence of dermal sensation before the booster lamp was switched on. We therefore preferred the first method, which we made the main one for most of out subjects.

The general results of the investigation were expressed in the following distribution of subjects.

For various extraneous reasons three subjects dropped out of the tests during the first half of the series and the data on them are omitted.

Skin photosensitivity arose in three subjects (V., S. and Gub.) and they produced quite significant results, although it required slightly more combinations than other series. A fourth subject produced outstanding results (e.g. in one test nine correct responses, two mistakes, and no misses), but the results in the control tests were much lower, and we refrained from using his data in the overall results of the investigation.

We considered the results on sensitivity emergence for the other subjects (M., K., and Greg.) to be negative. The process was apparently exceptionally slow with them. M., for instance, was given about 500 combinations during 52 test days; he made no correct responses at all until the 46th run, though he repeatedly claimed from the 34th onward that he felt quite clear sensations. After one trial he said: 'I feel something, but can't risk lifting my hand'. His last six runs yielded two or three correct responses. With the other two subjects, after a total of 30 to 35 trials, there were occasional correct responses, generally within the limits of probability. Out of this group we could thus use only the data for the first subject M.

The remaining subjects were used for special control tests, which we shall consider below.

Let us now analyse these data from the standpoint of the

special problem facing us. For this purpose we can use the trials with six subjects, who constituted two different groups as regards the number of combinations, and three groups as regards the emergence of sensitivity. Using this grouping we get the following distribution of subjects (Table 5).

Table 5

Stages in the formation of sensitivity	Subjects	
	More than 300 combinations	Fewer than 300 combinations
Sensitivity completely absent	K.	Greg.
Sensitivity first appears	V., Gub.	M.
Sensitivity quite clearly expressed	S.	V., Gub.

The reason V. and Gub. are in two groups at the same time is that the data obtained with them fall into two phases, as it were, one of an initial display of correct responses and another of pronounced sensitivity, coinciding with the different number of tests performed by them.

As a rule we made control tests (without reinforcement) only after subjects began to produce a marked increase of correct responses compared with mistakes. Only with two subjects, K., and Greg., in whom it could not be said that dermal photosensitivity had been established at all, were sensory conditioned-reflex tests carried out just the same at the end of the series. Their results, however, as was to be expected, were negative; in spite of the very large number of combinations, a sensory reflex was not formed in them.

With V. we began the conditioned-reflex control tests after 150 combinations, when she made three correct responses without any mistakes. With Gub. we began the control tests in exactly the same conditions after 210 combinations. In both cases the results were negative.

We then continued the series with both of them and reinstituted control tests after approximately 400 combina-

tions when there was no longer any doubt about photosensitivity. As in the tests with other subjects, the control was made after 'missed' stimuli as well as after correct reactions.

The results of these tests, too, were *negative*. Only in one subject, in the very last experiments, was there a stable, but slight, rise in visual acuity under the influence of the conditioned stimulus.

The results obtained could not be discussed, of course, before other tests had been made to elucidate whether it was in fact *possible* for a sensory conditioned reflex to be formed in these conditions. We therefore followed up the experiment described above with a special control series.

This series was carried out on four subjects and differed from the preceding one in that the inadequate conditioned stimulus was replaced by an adequate one that was normally sensed by subjects (a metronome). By the eighth to tenth test day we obtained distinct *positive* results. For V., for instance, we got the following in the eighth trial: 1.1 to 1.2 standard units in normal lighting and 1.65 after the conditioned stimulus; for subject P. the corresponding data (on the tenth day) were: 1.0 without the stimulus, and 1.35 after stimulation. Similar results were obtained with the other test subjects as well.

Thus, from a comparison of these results with those of the preceding investigations, we can draw the following preliminary conclusion: if the subject does not sense the neutral agent (i.e. does not distinguish it), a conditioned reflex cannot be induced. In this case we have first to convert this agent through the influence of special conditions into one to which the organism was not only irritable but also sensitive, i.e. into one 'distinguishable' by the subject (as Pavlov put it) and capable of evoking an orienting reaction in him. Only *then* did it also become possible to form a conditioned reflex to the given agent, now distinguishable by the subject. This meant that *the process resulting in the emergence of sensitivity to an ordinarily unsensed agent and the forming of a conditioned-reflex association were not identical processes.*

Although this conclusion still needs further experimental verification, since we do not consider the procedure of the last investigation entirely satisfactory, it agrees well with the data of the other investigations. We must single

out especially Bogoslovsky's findings; during the tests on the forming of sensory reflexes he trained subjects to an increasingly fine differentiation of stimuli (the length of lines and the tempo of a metronome). His experiments showed that a development of differentiation of conditioned reflexes in a successive process cannot be obtained unless the differences in stimuli are already subjectively noticeable by the subject.

The general view of the process as a whole to which we were coming can be expressed as follows.

Any organism exists in a continually changing environment, but relates itself differently to various changes in it. Some of them cause no active process at all or, if one can so express it, no 'answering' process, i.e. do not cause a biological reaction in general in the organism. Others produce some reaction or other in the organism, and these changes are agents that represent the environment as one pole of a process of reciprocal action. But these changes themselves, as agents, can have a dual significance for the organism: namely, either a directly vital one, or an orienting one, a signalling significance in the broad sense of the term. This signalling role requires (1) a process linking the biological effect of the particular influence within the organism with its central co-ordinating system (which differs, of course, at the different stages of the evolution of organism), and (2) a process whereby this role is *implemented*. Therefore, when we study this second process specially, in tests involving the formation of conditioned reflexes, we always tacitly assume the presence of the first one, i.e. that of sensitivity and sensation.[49] Hence we get the notion, on the one hand, of an orienting reaction as one expressing the presence of this first process before the conditioned reflex is formed, and dying out soon as the latter is formed, and, on the other hand, of the work of an organism irritable to influences evoking processes of the first kind, i.e. a notion of work of the receptor itself, of the sense organ itself.

As regards the orienting reaction, it is nothing else than

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[49] We consider it specially important to stress that when we speak of 'sensed influences' we of course have in mind influences that can actually be sensed without special training, but which may not necessarily, in each given case, evoke a consciously perceived sensation at all.

a necessary expression of the first process, when the second 'contact-making' process has not yet occurred. The *movements* of the orienting reaction do not in themselves, as Pavlov showed perfectly clearly in his reply to Lashley, determine the formation of a conditioned reflex at all.[50]

We must consequently recognise that this first process, in its essential characteristic in relation to the agent evoking it, terminates in a state of the central co-ordination system evoked by the agent (in the state of the cortex when we have higher animals in mind). The subsequent effect then specifically characterises the action of yet another agent for which the first one becomes a substitute or 'surrogate' when a conditioned-reflex connection is formed.

As regards the receptors themselves, the problem of their work once more becomes a special question when we are studying the second or 'contact-making' process, a question that in no way merges, for example, with that of the differentiation of a conditioned reflex. When examining the problem of differentiated inhibition, for example, Pavlov wrote:

> One is forced to the conclusion that there is an essential distinction *between the nervous system's establishing of a difference between external agents in general, and differentiation of said agents by means of conditioned reflexes. The former is revealed as an irritable process in the form of an orientation reaction*, and exploratory reflex that only secondarily affects the conditioned reflexes in either an inhibiting or a disinhibiting manner. The latter is expressed in the development of an inhibitory process that is the result, so to speak, of a struggle between excitation and inhibition. As we shall see later, this struggle is sometimes very tough; it is conceivable that it is sometimes too difficult and then, because of it, *things cannot always be brought to full utilisation of the results of the actual analysis of the external agents for the organism's general activity*. When that is the case, study of the nervous system's analyser activity by means of conditioned reflexes will also be deficient. In any event, it is an interesting question.[51]

The vulgar confusing of these processes, with which we have had to deal in the psychological discussion of the genesis of sensitivity, is thus absolutely unwarranted and is simply due to a misunderstanding of this idea of Pavlov's.

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[50] See: I. P. Pavlov. The Reply of a Physiologist to Psychologists. *Psychological Review*. 1932, *39*, 2: 97-127.

[51] I. P. Pavlov. Lectures on the Work of the Cerebral Hemispheres, Lecture 7, *Pol. sobr. soch.*, Vol. 4, pp 142-143 (My italics—*ANL*).

Investigations of conditioned reflexes always, in accordance with their special purpose, presuppose the reception of a neutral agent. The genesis and dynamics of the receptor function itself, however, are a special matter that needs to be studied. The conception of conditioned reflexes, therefore, not only does not eliminate this question but on the contrary, calls for special treatment of it.

It is a matter, of course, of *distinguishing* between the two processes and not of *separating* them. Contemporary physiological views on the activity of the receptor apparatus preclude any idea of a receptor as an organ with a function fixed once and for all, that provides the basis for a centripetal process independent of central influences. There are also feedbacks—connections of nerve centres with a receptor that determine its functional properties. The receptor problem is consequently only one aspect of the *general* problem of the organism's adaptation to the conditions of the environment.

7

Let us continue our exposition of the course of our experimental work.

The fourth investigation devoted to the problem of sensitivity was undertaken by Asnin (of the laboratory of the Chair of Psychology of the Kharkov Pedagogical Institute) under our supervision. Here we shall describe only the posing of the problem, the procedure, and the main results of the research.[52]

This takes us back to one of the first facts we established—that sensitivity to an ordinarily non-sensed influence can only be acquired when the subject concentrates on discerning a 'signalling' influence. From that, too, comes the difference in results obtained in the completely 'secret' tests and in those in which the subject knew there was an influence that would forestall an electric shock, and sought to avoid the latter.

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[52] See the following preliminary report on this investigation: V. I. Asnin. Concerning the Conditions for the Rise of Sensation. *Nauchnaya sessiya Khar'kovskogo pedagogicheskogo instituta* (Kharkov, 1941), p 27.

In this fact, in the form in which it found expression in our tests, we can see the direct influence of the subject's conscious activity on the processes under investigation. Attempts to explain phenomena in terms of the active role of consciousness, voluntary attention, etc., are of the kind still resorted to in psychology, when workers naively wish to justify the 'psychologicality' of a phenomenon and stress its 'irreducibility' to physiological processes. There is no need to demonstrate specially that such explanations, instead of really overcoming a subjective, phenomenalistic, parallelist view of the psyche, only mask it. They can make sense essentially only in a system of prescientific psychological ideas. These trends explain nothing in the concrete facts conclusively on the basis of their interpretations drawn from subjectivist traditions; displaying total theoretical helplessness, they withdraw into general statements about the activeness of consciousness. In themselves these statements are indisputable; we, too, insist on the active role of consciousness. But what follows from it for the tasks of concrete, scientific, psychological research? Not, of course, a simple reference to this proposition, but a requirement for scientific *explanation* of the appropriate actual facts.

The process of the emergence of sensitivity to non-adequate stimuli that we are studying is only possible when the subject knows the experimental situation. But how are we to explain this role of knowledge, of the subject's awareness of the experimental situation? Does it really consist just in the fact of awareness of the situation itself? Or is this awareness only the special form in which the general condition for the rise of sensitivity is revealed in the *given* concrete experiments? This last question has special importance in light of the main—genetic—problem of our investigation, because, in trying to penetrate to the real origin of sensitivity by the circuitous paths of laboratory testing, we cannot, of course, assume any such factor at the incipience of the mind.

We thus again encounter one of the many difficulties inevitably involved in the experimental-genetic method. In analysing the results of the research, we again have to keep in mind, above all, the idea of a common path of evolution and proceed precisely from that idea in building a special hypothesis.

It was not by chance that we called the situation of our

experiments a 'search situation'. By introducing the appropriate instruction we evoke a specific form of directed activity in the subject. In our experiments on man this activity has the form of an inner process, a process of consciousness; it is an inner search, an act of attention. The 'track' of this unique process necessarily passes through the influence of the experimental agent, for the subject's inner search is so directed by our instruction. This inner process is also that which connects and correlates the mediating influence with the influence to be mediated—in our case the light beam and the shock current. It is not the form of the process that is significant here, but the process itself, in whatever form—internal or external—it develops.

We could test this hypothesis experimentally. To do so we had to deprivet the process correlating the two influences with one another of the form of an *inner* search, or inner attention that it had had. We had to turn it first into an external act, i.e. the genetically initial form of any activity. Second, we had to remove any possibility of an appeal to the subject's consciousness when analysing the facts, i. e. the test situation had again to be made entirely 'clandestine' by completely ruling out knowledge on the subjects' part that they were being subjected to some special influence on which they could orient themselves in the experiments.

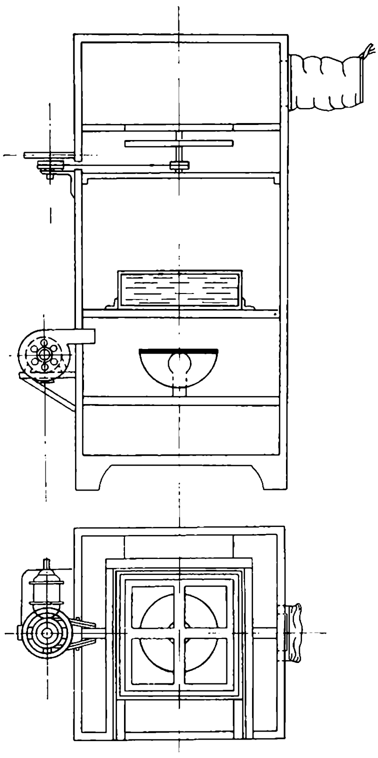

Fig. 12.

We developed a test technique that met these conditions. We built an apparatus that was a metre-high tetrahedral prism closed

on all sides and divided internally into four chambers (see Fig. 12). The bottom chamber, located near the floor, accommodated a strong light source and an inlet for the nozzle of an electric fan for air cooling. The next chamber up contained a large filter to absorb heat rays; it, too, was linked with the air-cooling system. The third chamber was for colour filters (of which there were four — one violet and three red). The filters were mounted on a frame which was divided into four squares (see the figure) and rotated on an axle fitted through its centre. The axle was driven by the rotation of an externally mounted filter-position regulator mechanically coupled with it.

The fourth chamber, at the top, served as the field of action for the subject's hand. It was fitted out as follows. One side wall had an aperture with a sleeve of opaque material that covered the subject's wrist. A current-conducting bracelet was attached to the free end of the sleeve and connected to one pole of an electric circuit. A glazed frame was set into the floor of this chamber exactly above the revolving filter frame, and also divided into four squares corresponding in size and location to the filters. Four large steel balls (ball bearings) were placed in shallow recesses in the corners of the framework, each at exactly the same point. The balls were connected with the other pole of the electric circuit via metal plates on the bottom of the recesses, and were so spaced that when the subject's fingers touched one of them, the palm of the hand, and in part the phalanges of the fingers, were above the corresponding square opening in the frame and so exposed to the action of the light beam. Understandably, if the subject stretched his hand to the balls in the row further away from him, the light coming up through the nearest aperture fell on the opaque sleeve covering his forearm and in that case, too, consequently, the subject could only be exposed to light coming through one aperture at a time. The colour filters for this apparatus were made to special order and were balanced as regards the thermal characteristics of the radiant flux passing through them.

As will be seen from this description, the apparatus was designed for the following experimental scheme.

Initially the subject underwent a series of practice trials, to become familiar with the layout of the upper chamber, feeling it by hand from outside through the sleeve, one end of which was fastened to the apparatus and the other clipped

over his wrist. The subject was instructed to remember the exact position of the balls, for which purpose he was trained to remove particular balls correctly from the chamber as instructed by the experimenter (far left, far right, near left, or near right). The main series of trials began as soon as the subject had completely mastered manipulation of the balls, i. e. when he acted as though they were in full view.

The subject was warned that the task was to remove *any one* of the four balls, but that he should act warily, and above all deliberately, for contact with three of the four balls would involve an unpleasant, painful electric shock; only one of the balls was not connected in the circuit and it was this ball that was to be found. The position of the safe or free ball remained unknown to the subject, of course; it could change from time to time, or sometimes remain the same.

The position of the commutation switch for connecting the balls to the circuit always coincided with the corresponding position of the colour filters. When the subject's hand approached the 'free' ball, it was exposed to violet light, but when it approached 'dangerous' balls, it was exposed to red light.

This method created an extremely lively test situation. Subjects' behaviour unwittingly suggested a comparison with that of a person trying to pick up something very hot: delays; 'idle' movements at the surface itself, i. e. without actual contact; rapid, very light contacts; and finally confident action. One difference was that, in the test conditions, the subject was in a situation to choose, to search; he could approach one ball, then another, come back again to the previous one, and only after that try real contact. When the choice was unsuccessful and the subject received a shock, the experiment was started again. A second difference was that testing a ball, unlike testing a hot surface, immediately produced an intense sensation (on the 'all or nothing' principle, so to speak), since an electric current of the order of 100 V cannot act at a distance, even when the air clearance between ball and hand was only a few tenths of a millimetre.

Subjects thus had the task of pulling out a ball with as few tries as possible. Sometimes their cautious search motions for the free ball went on for fairly long. This external

search, this external act of the subjects was obviously conscious, although only in the sense that they knew its purpose. Any consciousness on their part of the inner correlation of the excitatory agents was entirely precluded. The 'inner search' was thus converted, in the experimental situation, into an objective external action that alone correlated the two influences. Granted, the action had a special character—a *searching* one. But such search actions are nothing exceptional; they are continually observed in animals. Recall, for example, the way a rat behaves in a maze after it has received an electric shock; there is the same alertness, the same pauses, turns, and cautious, 'probing' movements.

What actual results did we get from this investigation?

Objectively, the subjects, who went through a series of up to 600 separate trials, averaged 75 per cent correct responses in the control tests, which is three times higher than the probability of correct responses, because the control tests were conducted by a special technique, which consisted in a subject being asked to say whether a *definite* ball, named each time by the experimenter, was live or not, after which he tested the correctness of his reply by actually touching the ball named. In individual cases the number of correct responses varied considerably, sometimes dropping to 50 per cent, and at other times rising to 100 per cent. It can thus be considered *that the possibility of the skin's becoming sensitive to visible light in external search conditions has been objectively established.*

On the other hand, we must note, in connection with the problem, posed by the previous series of tests, of the possibility of differentiating sensations caused by the influence of a light beam, that the present investigation also provided a positive answer, because its technique was built precisely on the principle of differentiation (between red and violet light).

The control tests made so as to check the results of the experiment enabled us to obtain data on subjects' self-observation, in addition to the above-mentioned objective quantitative findings.

It turned out that the subjects used in these tests, like those of our other series, orientated their behaviour on the peculiar sensations arising in their hand. When questioned about the nature of these sensations, they gave replies

similar to those of the subjects who had co-operated in the previous investigations. Furthermore, the following feature was noted in them: they related the sensation experienced as the hand approached a 'dangerous' ball to the action of electric current which was allegedly felt at a distance. This point seems to us to deserve special mention not simply because it raises new questions, but also because it confirms that the real test conditions determining the subjects' choice were in fact kept completely 'secret' from them.

What general tentative conclusions can we draw from this last, fourth, investigation?

The conditions of this investigation obviously had something in common with those of our previous ones, which specifically governed the conversion of a normally unsensed influence into sensed one. It is clear, above all, that this had nothing to do with the subject's knowledge or awareness of the relation existing between the agents. It was sufficient for the two agents to be *actually correlated with one another in the subject's activity* in a definite way.

This correlation, obviously, is undoubtedly necessary. A single objective temporal association of the two agents, adequate to form a conditioned reflex when there is a pre-existing, so to speak 'ready-made' sensitivity, is, therefore, inadequate in this case to lead to its initial rise. It is that which explains the negative results of the series with which we began our attempts to solve our problem experimentally. In this series, incidentally, the subjects were active as well, and we must thus assume the existence of a certain inner activity in them. This activity, however, differed essentially from that of the subjects in the later experiments. It had a quite different direction. In the intervals between electrodermal stimulations, it may be that subjects, wishing to avoid the unpleasant feeling of expectation, mentally abstracted themselves from the experiment, thought about plans for the rest of the day or occupied their consciousness with something different; or they might, on the contrary, in preparing themselves for the sensation of a shock, have tried to work out the length of the possible interval or reduced the pressure of their finger on the key, hoping in that way to weaken the anticipated effect of the electricity; or again, their inner activity might have been directed toward something else still. In any case, it did not correspond to the purpose of an in any way adequate test situation;

there was a certain active process, but it was not one capable of correlating the two influencing agents. Hence, too, the negative results of those trials.

From the point of view developed here, the emergence of sensitivity and the development of an orienting reaction are thus possible in the operational conditions of a search situation. That is especially clear in situations in which the activity is performed externally (e. g. when an animal is subjected to the action of a neutral agent while moving in a real spatial field). An orientation of activity on a particular agent then operates literally as a real change in its trajectory, and not simply metaphorically.

In stationary experimental conditions, on the contrary, these relations prove to be maximally concealed. The whole process begins, therefore, to seem to depend on purely formal—temporal and force—conditions, behind which it is not always easy to see the real conditions that shape an animal's activity in a natural situation. That, it seems to us, is the source of the limitation, of 'test-bed' experiments, as has been pointed out so often by workers who study behaviour in conditions in which the animal finds itself, not in an artificial situation, varying between diffuse attempts to get out of the experimental set-up in general and sleep, but in settings of clearly expressed activity corresponding to specific tasks.

Analysis of the phenomena of sensitivity thus brings us back once again to the problem of conditional reflexes, but now we can approach it rather differently, because, if it is not abstracted from the question of the origin and dynamics of sensory processes proper, as is frequently done, the process of forming conditioned connections will itself, of course, appear rather different and will be set in a wider biological context.

IV. Discussion of the Results and Certain Conclusions

1

Our investigation of sensitivity ended with Asnin's experiments. That did not mean, however, that the prospects for further experimental treatment of the problem had been exhausted. Rather the contrary; only now, as a result of

the work done, did they become really clear for the first time.

We had, in fact, made only the first steps. Some of the data obtained still needed to be checked and much still needed to be revised and refined; a whole number of questions had arisen during the work and called for additional experiments to clarify them.

On the other hand, other possible lines of inquiry had come to light, especially the possibility of genetic investigations proper, i. e. investigations on animals.

Taking the historically formed view of sensitivity as primarily a subjective phenomenon, we had begun our study of its origin in man in conditions appropriate for handling subjective data. Now, starting from the fact that the rise of a subjective experience of sensation corresponds to the emergence of a possibility of altering an organism's activity in relation to its external mediums (in higher animals and man through conditioned nervous reflexes), we can rely on a rigorously objective criterion, namely: the presence of an orienting reaction, the forming of conditioned-reflex connections, or a process that is its genetic equivalent. The experimental problem will thus now be to study the conditions in which an influence that used to be unable in itself to alter the studied external activity of an animal is converted into one capable itself of making the change demanded by the particular conditions. This is the only way we can try and find out more about the situations at the various stages of evolution that we label by the arbitrary term 'search situation'.

The second line of inquiry noted is to pass on to study of the conditions of the conversion of normally subthreshold stimuli into ones that evoke sensations, i. e. to study of the conditions in which a peripherally emergent process is 'plugged in' (figuratively speaking) to the higher centres of the nervous system whose work governs the unity of the directional effect at any given moment of our activity. We can, of course, consider in principle that *any* process arising at the periphery, any reaction, influences the organism's vital activity as a whole in one way or another through a numerous neural and humoral connections, but influences of that kind are by no means identical with the influences of processes that 'roll up' to their respective cortical centres (as Orbeli puts it).

Special research along these lines is only just beginning, but from some of the work we can now already consider that the hypothesis of the rise of a sensation of influences usually unperceived is corroborated by this material.

In the field of the dynamics of visual sensitivity the clearest findings come from Salzi's work,[53] which is undoubtedly wrong in its theoretical premises and has therefore rightly evoked unfavourable criticism,[54] but whose factual basis is undoubtedly very interesting precisely from the angle of our problem. Salzi put subjects with low visual acuity in a situation requiring perception of objects below the threshold of their various sensitivities. At the end of his series of tests marked shifts were observed in the visual acuity of the majority of the subjects. In tests with subject M., for instance, whose visual acuity was initially 0.4, the following data were obtained (over a period of three months): the results of the first experiments (in units of distance to the object) were 48-60; then successively 50-75, 55-85, 60-95, 80-120, 80-110, 80-145 and 70-120.[55] Salzi noted that the shifts of sensitivity obtained through the experiment were also revealed in other conditions and with other objects, i. e. *were transferred.* He characteristically attributed the possibility of such shifts to subjects' activity toward the special task posed by the experimental situation. The poorly expressed results observed in individual subjects were correspondingly explained by their being unable to carry out the instructions which demanded intense inner activity of them. Salzi therefore proposed a special active mental-representation test for ascertaining quite clearly whether it was advisable to use a particular subject in tests.

We find essentially similar data in other, quite different investigations, that pose the same problem in quite another way. As regards auditory sensitivity, there is Bronstein's work on the sensitisation of hearing[56]. He estab-

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[53] See: E. Salzi. *La sensation. Etude de sa genèse et de son rôle dans la connaissance* (Alcan, Paris, 1934).

[54] See: H. Pieron's review of Salzi's book. *L'Année psychologique*, 1934, *35*, 11: 524.

[55] See: E. Salzi. *Op. cit.*, p 104.

[56] See: A. I. Bronstein. On the Sensitising Influence of Auditory Stimuli on the Hearing Organ. (Communication 3.) *Byulleten eskperimental'noi biologii i meditziny*, 1936, *2*, 5: 365-367.

lished the existence of a selective lowering of the threshold audibility under the influence of repeated sound stimuli, reaching 17.0 db, pointing out that 'a regular increase in sensitivity ... is observed only in those tests in which *tense listening* occurred and extended only to the excitatory tone'.[57]

Sensitivity to pitch differences is also posed in direct connection with the *content* of 'controlled' activity in Kaufman's work. In opposing the attempts of Seashore, Whipple, and others to treat individual differences in the thresholds of pitch sensitivity as invariant, innate features of an organism, Kaufman demonstrated from special material (1) the dependence of thresholds and of the type of perception of pitch differences itself on the nature of subjects' musical activity (pianists, violinists, cellists) and (2) the possibility of a shift of thresholds and change in the type of perception of differences of pitch (macro- or micro-intervals) itself. Her study of children showed a distinct difference between child-pianists and other child-instrumentalists: the former did not perceive micro-intervals (5 Hz or less) while the latter did. The important point here is that these features can vary; pianist subjects, by 'hearing differently', began to distinguish micro-intervals in spite of the 'wrong' character of the sounds for them as pianists. 'Ability to distinguish differences of pitch is not an innate, physiologically constant faculty, ... on the contrary, it is a *function of musical activity*' and depends on the 'actual features of the particular individual's practical work'—so she expressed the main idea of her research.[58]

It is difficult to assess the results of such investigations fully now. It seems to us that their importance, which comes from comparing the facts of the sensitisation of specialised sensory apparatuses with facts relating to the origin of sensitivity, is exceptionally great theoretically. We can surmise that, in the early stages of evolution in conditions of a much lower specialisation and stability of sensory processes, those caused by adequate stimuli were also built on the principle of functional development that we have observed in conditions

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[57] *Ibid.*, p 366.

[58] See: V. I. Kaufman. Perception of Slight Differences in Pitch. In: V. P. Osipov and V. G. Ananiev (Eds.) *Issledovaniya po probleme chuvstvitel'nosti* (Leningrad, 1940), pp 114-138.

of the use of sensitivity in relation to inadequate stimulation. This is because underlying the *physiological* adequacy or inadequacy of stimuli is their *biological* adequacy or inadequacy. The relevant facts have been well studied and can be generalised in the following formula: to evoke an animal's reaction, a physiologically adequate stimulus must be biologically adequate.

Studies of the dynamics of sensitivity, on the other hand, are of immense, direct, practical importance. Bringing out the connections of sensory development with and dependence on the content of activity not only poses the problem of sense perception in a new way but also broadens its context by opening up a possibility of shaping that sometimes really astonishing *sensitisation* to which a vital need to compensate sensory defects (blindness, deafness) or the special demands of certain professions lead spontaneously.

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In conclusion, it remains to present certain general results. We come back once again to the problem of sensitivity and conditioned-reflex activity, but now so as to note certain genetic conclusions that seem to us to follow from Pavlov's teaching.

The theory of conditioned reflexes opened up

> an enormous second area in the physiology of the nervous system—that of the nervous system that mainly coordinates not the individual parts of the organism, with which we have hitherto been mainly concerned, but the organism and its environment.[59]

What is the 'main point' of this 'second area of physiology'? To grasp this main point, Pavlov said,

> it is necessary to distinguish the two kinds of properties in the objects of the external world that act on an organism: viz., *essential properties* that absolutely govern a certain reaction in some organ or other, and *inessential properties*, which act temporarily and conditionally. Take, for instance, a solution of acid. Its effect as a certain chemical reagent on the oral cavity is always invariably expressed, among other things, in a discharge of saliva, necessary, in the interests of the organism's integrity, to neutralise, dilute, and remove this solution.

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[59] I. P. Pavlov. *Dvadtsatiletnii opyt*, 5th ed., (Moscow, 1952), p 23.

> The other properties of the solution—its colour and smell—*are not in themselves related to the saliva*, nor the saliva to them. At the same time one must not overlook a fact that is of immense importance in the phenomena of life, namely, that an object's inessential properties are stimuli of an organ (in our case the salivary glands) only when their action on a sensitive surface of the organism coincides with the action of the essential properties.[60]

That, as Pavlov put it, is 'just further adaptation'. In the first, 'physiological' case, 'the activity of the salivary glands proves to be linked with those properties of the object to which the action of the saliva is addressed'. In this case the animal is stimulated by the 'object's essential, unconditioned properties'.

It is a different matter in the second, 'psychic' case.

> In psychic experiments the animal is irritated by properties of external objects that are inessential for the working of the salivary glands or even quite accidental.[61]

Such is the classic, original posing of the problem of objective study of animals' higher nervous activity (behaviour), i. e. of conditioned reflexes. Such also was the original generalisation of the principal facts relating to the physiology of higher forms of that 'infinite adaptation in all its totality that constitutes life on earth'. These facts are well known, and so, too, now, are the specific laws of the signalling activity of the cerebral hemispheres with multiple signals and variable signalling, which explain the facts scientifically and physiologically.

The principle discovered by Pavlov is the actual principle of the structure of higher, i.e. psychic, activity, that is to say, activity intrinsically associated with sensitivity and an organism's faculty of sensation and mental reflection of its external environment.

The real inspiration of Pavlov's research lay precisely in his attempt to clarify the 'mechanism and vital meaning of what preoccupies man most of all—his consciousness, torment of his consciousness'—in the final prospect of a commencing 'convergence and ultimate merging of the psychological and the physiological'.

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60 I. P. Pavlov. *Poln. sobr. soch.*, Vol. 3, Book 1, (Izd-vo AN SSSR, Moscow, 1951), pp 29, 38. (My italics—*ANL.*)

61 *Ibid.*, p 24.

It is natural therefore that the *main* trend of development of Pavlov's research and that of his school took an ascending genetic line: viz., of bringing within the range of objective physiological study of increasingly complex behavioural processes in higher animals—dogs, monkeys, anthropoid apes—and then of trying to transfer the experimental data obtained to man. In principle, however, and to some extent in factual investigations, there was also a second, descending line.

'Individual adaptation exists *throughout the animal kingdom*. It, too, is a conditioned reflex, a conditioned reaction.'[62] The main principle consequently also holds for the lowest stages of evolution. Even at the lowest stages there is consequently a difference between the 'physiological' case of an organism's compensation to its environment, to use Pavlov's language, and the conditioned, 'psychic' case. Here as well, consequently, the 'main point' of this second aspect of an organism's vital activity has to be grasped somehow.

The general principle discovered and developed by Pavlov in research into the activity of animals at a relatively high stage of biological evolution, necessarily includes features that are specific only to that stage. It is difficult therefore to assume that it can be mechanically transferred to the behaviour of much less highly organised animals. From that incontrovertible proposition, however, the inference is sometimes drawn, quite incorrectly from our point of view, that this principle holds only at those stages of evolution where it can be embodied in forms and laws identical with, or very similar to, those originally described. But it is not noted that such a limitation directly contradicts Pavlov's idea quoted above, that about the existence of conditioned reactions 'throughout the animal kingdom'.

A number of circumstances underlie this incorrect limitation of the principle of conditioning, or signalling. One is that the original facts have not been adequately analysed as required for genetic investigation along the descending line.

The field of conditioned reflexes was opened up historically when we passed from study of nervous processes that correlate individual organs to study of the nervous

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[62] See: I. P. Pavlov. *Dvadtsatiletnii opyt*, p 486.

activity that correlates an organ (the salivary gland) with environmental influences neutral to its functioning. In this way a double distinction arose and was emphasised, on the one hand between two types of physiological *process* (the two 'parts of physiology'), and on the other hand between two types of *relation* of the excitatory property to an organ, i.e. relations of properties directly connected with the physiological function of the salivary gland, and the relations of properties (light, sound, etc.) that *in themselves* 'remain without any influence on the salivary gland' but which, in the event of their activity becoming objectively combined with that of the former kind, can adopt their role and so become their 'surrogates' (in Pavlov's expression). In this connection, it needs to be pointed out that the biological significance of these newly discovered relations was immediately fully appreciated.

The first distinction in *this*, concrete expression of it, was understandably only justified in the early stages of the research. In the later development of the Pavlovian school (the work of Bykov and others), the principle of conditioned-reflex activity was also extended to processes that establish relations between organs. Nevertheless the distinction fully retains its *general* significance. Conditioned relations belong, above all, to the processes that compensate the organism with its external environment, that are generated by it, and that serve for further adaptation to it. Unconditioned relations, however, are first and foremost relations that mediate the inner, intimate processes of maintaining an organ's life. They are therefore also manifested in its external relations only when properties operate on an organ for which it is specifically 'designed', as Pavlov expressed it, that is to say which are most intimately, directly connected with its functioning, with its life. In its general form, therefore, i.e. abstracted from the enormous complexity of the organisation of higher animals (which our problem requires), this distinction appears to us as a difference in general between processes directly realising life and processes corresponding specially to the variability of the environment—a distinction that is quite legitimate for lower stages of biological evolution as well.

The second, basic distinction remains just as valid genetically. But to resolve the genetic problems in it, as in the first case, it is necessary to take this distinction in its most

general possible form. When studying a complexly differentiated organism, Pavlov had in mind the relations of the particular organ that he had chosen for study with external influences. The relation of an organ, however, is a special case of the organism's relations as a whole. In conditions of a much lower differentiation and lower specialisation of its organs, therefore, it is fair to assume that this same principle of a link with the environment still holds good, but in a wider sense. The specific laws, it goes without saying, may then prove to be quite different, just as different from the laws established in tests on dogs as the anatomical organisation of lower animals and their life conditions differ from the anatomical organisation and life conditions of mammals.

With a genetic approach to Pavlov's teaching, furthermore, the following problem most important for us arises.

When studying conditioned reflexes we are always concerned with a highly complex system of receptors and their equally complex representation in the cortex, i.e. with a highly differentiated system of analysers. It is the readiness, the functional determinacy, and relative stability of sensitivity at the higher stages of evolution that enable us to get a clear picture of the cerebral hemispheres' 'contact-making' activity. The sensory sphere, however, and its own dynamics, seem, moreover, to fall out of the field of view of research, which is restricted to studying the dynamics of the connections of centres. The processes in these centres are themselves taken as a given precondition. In classic studies of conditioned-reflex activity we are thus concerned as a rule solely with processes of the activity of agents to which a particular organ (e.g. the salivary glands) is indifferent, whereas the *general* signalling significance of these agents has already been fixed morphologically in the course of phylogenetic development in the form of unconditioned orienting reactions. In experiments on higher animals the general principle of 'conditioning' also emerges directly only from this genetically secondary aspect, i.e. only, as it were, in its subsequent manifestation.

To explain this idea, let us again consider an animal's response to some neutral agent, (e.g. the beat of a metronome). In what sense, actually, is this agent 'neutral'?

(1) It is neutral in that it does not originally cause the process being investigated, e.g. the salivary reaction; it is

therefore neutral in relation to the functioning of that *particular* organ, i.e. its influence does not in itself have a direct relation to the biological activity of that organ.

(2) The agent is also neutral in another sense: it can be taken that it has no direct relation *in itself* to the vital activity of the organism as a whole, meaning by that such fundamental life-supporting processes as those of defence, feeding, and reproduction. This qualification is necessary here because this agent is adequate to a special organ—a receptor—and because it *unconditionally* evokes a specific reaction, namely, an orienting reaction. The receptor itself, however, in this case the organ of hearing, like the orienting reaction initially associated with it, already performs a special unconditioned function that is admittedly different in principle from that, for example, of the salivary gland, which is directly linked with maintenance of the animal's life. The existence of this special function is also a prerequisite for conditioned-reflex control of an organism's directly vital processes. The *one* principle thus has *two-fold* expression here—a basic general one as the principle of the organism's correlation with the environment mediated by the notion of neutral agents, and a more special one as the principle of conditioned (temporary) nerve connections proper. Clearly, only the first expression of this principle can have broad genetic significance here; the other is a concretisation of the principle in relation to animals that already have developed, specialised analysers and an elaborate nervous system.

Hence two main conclusions follow from the angle of the genetic approach to the problem.

One is that we must distinguish clearly between 'conditioned' activity in the broad sense of the term on the one hand, i.e. an organism's activity mediated by agents neutral to its vital functions, and conditioned-reflex nervous activity in the proper sense on the other hand, i.e. conditioned nervous reflexes proper. Activity of the first kind, being biologically set, can also be realised through the organism's species adaptation mechanisms, while conditioned-reflex activity proper is always individually adaptative. In the first type the main difference between influences must be that between influences that are of directly vital significance on the one hand and those that mediate the maintenance of life on the other hand; in the second type it is the difference

between unconditioned influences (stimuli) that evoke innate reactions on the one hand, and conditioned stimuli on the other hand that cause a given reaction only through the rise of an appropriate nerve connection in the animal's individual experience. The two pairs of concepts consequently do not directly coincide with one another. An unconditioned stimulus may, at the same time, also prove to be capable of mediating an organism's vital functions, i.e. of acting on an analyser (one of the specialised organs that itself implements just this mediated connection between the organism and its environment). That is possible because the principle of a conditioned reaction in the broad sense (a mediated reaction) and the principle of a temporary, conditioned connection are two different, though genetically inter-related, principles. Pavlov pointed that out in one of his books.

> When does a temporary connection, a conditioned reflex, develop? Let us take a living example. An animal organism's most essential link with nature around it is the link through certain chemical substances that must constantly form part of this organism, i.e. the food link. At lower levels of the animal kingdom only *direct* contact between food and the animal organism, or conversely between the animal and food, leads in the main to food metabolism. At higher levels these reactions become more numerous and more remote. Smells, sounds, and pictures now direct animals already in wide areas of the environment... Countless varied and remote external agents are thus, as it were, signals of food matter, direct higher animals to catching it, and drive them to make a food connection with the external world. *Hand in hand with this diversity and remoteness, the constant connection between external agents and the organism comes to be replaced by a temporary one*, because (1) remote links are essentially temporary and changing ones, while (2) there would be no room for them all in their multitudinousness, as permanent connections in any apparatus, however voluminous.[63]

In other words evolution consists, on the one hand, in the organism's direct relations with the environment being converted into more 'remote' ones directed by various signals, and on the other hand, in there being, 'hand in hand' with this, a conversion of the organism's constant connections with external agents into temporary ones. The use of concepts like conditioned-reflex connection, conditioned stimulation, unconditioned excitation, and so on, which apply

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[63] I. P. Pavlov, *Dvadsatiletnii opyt*, p 191 (my italics— *ANL*).

to the activity of highly organised animals' nervous system, at least calls for grave reservations in regard to lower organisms. The more general concepts, however, those of mediated activity, signalling effect, orientation, etc., can be used to cover a whole range of corresponding genetic phenomena without thereby losing their precise meaning.

Another conclusion that we must draw from the angle of the genetic approach to the general principle of an organism's signalling activity already applies directly to the problem of sensitivity.

The fact that Pavlov's theory of higher nervous activity treats an organism's sensitivity to neutral agents as a ready-made precondition for the formation of conditioned reflexes that is expressed in the existence of an orienting reaction unconditioned by nature, necessarily leads to abstraction from the dynamics of the animal's needs, or rather the dynamics are not traced as such in the study of higher nervous activity but only in their reflection in the forming of conditioned connections.

> In our tests (Pavlov wrote) we must ... when comparing our results with phenomena of the subjective world, speak of the dog's attention and not of the existence of its wish, as the main condition for the success. The animal's salivary reaction could be regarded in the subjective world as the substratum of an elementary, pure representation, of a thought.[64]

The animal's wants ('wishes') have sense, and their sense is traced experimentally, but only in terms of their influence on the selectivity of the animal's reactions. Irritability, which depends on the state of needs, does not belong directly to the sphere of the formation of nerve connections, and is a special problem.

It is another matter when we pass to genetic research. The question of how organisms originally single out agents associated with their vital needs then becomes the basic one because, to understand this process in its development, we must first trace the conditions in which direct links with the environment are converted into 'ever more numerous and remote' ones, and this is also the essence of the problem of the evolution of sensitivity. Genetic investigation of the higher activity of lower animals must consequent-

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[64] *Ibid.*, p 29.

ly start with this problem. And we must bear in mind that the development of sensitivity is not only expressed in an ever greater differentiation of sensations; genetically, sensitivity obviously also alters qualitatively, and new forms of it also appear.

Orbeli is one of the few who have recognised the profound genetic significance of Pavlov's work. We are inclined to add that Pavlov's method itself seems to us objectively the experimental, genetic method in the sense explained above. We think that investigation of conditioned salivary reflexes in dogs, by-passing a stratum of more complex processes, as it were, brings out much simpler and at the same time more profound genetic relations. That applies above all, once again, to the sensory sphere.

Experiments with individual isolated stimuli are undoubtedly a technique that puts the dog in quite special conditions. It has the advantage of bringing out the dynamics of the nervous processes in the cerebral hemispheres especially clearly and accessibly but at the same time cuts off the possibility of penetrating the dynamics proper of the sensory processes. Conversely, as soon as we complicate the conditions of the experiment, factors associated with sensitivity itself come to the fore. Experiments in forming a temporary connection between two indifferent excitations show, for example, that continuous maintenance of the animal's orientative reaction to each of the combined indifferent excitations is needed, while the resulting connections have the curious feature that, once formed, they persist for months and even years. In general, the more complicated the task is, apparently, the more conspicuous is the role of the processes of sensitivity proper, especially when we are dealing with dynamic relations.

Analysis of the main theses of Pavlov's theory of higher nervous activity in terms of the tasks of genetic research thus shows that underlying the concept of a conditioned 'psychic' reaction are two principles: (a) the general biological one of vital activity mediated by 'signals', i.e. by neutral influence of some sort, and (b) the principle proper of temporary nervous connections, which is a special expression of the first, more general principle in the work of the cerebral hemispheres. The analysis shows, furthermore, that the more general principle comes to light above all in the formation of an animal's sensory sphere.

Finally, it is quite clear that the principle of signalling, conditioned relations between an organism and its environment must not be conceived as primordial. For, in order for a process to arise whereby the action on the organism of properties 'that are essential and absolutely determinant' is 'replaced' by the effect of properties that are, in themselves 'inessential, temporarily, conditionally operating,' there must inevitably already be processes that directly correlate the organism with those first properties in *themselves* essential for its life. This implies that there is a passing from the simplest forms of life, life that is organised by direct, unconditioned relations, to life that includes conditioned, signalling relations; there is, consequently, a problem of the *genesis of sensitivity*, *of the genesis of sensation.*

We thus come back again to our initial hypothesis, but now no longer through analysis 'from below', starting with facts that characterise the general direction of evolution at the stages of the simplest life, but through analysis 'from above'—from consideration of the main principle of the higher nervous activity of higher animals.

THE BIOLOGICAL AND SOCIAL IN MAN'S PSYCHE

1

The problem of the biological and social is decisive for a scientific psychology.

I do not intend here, of course, to survey the work done on this problem in the Soviet Union over many years, but shall limit myself just to setting out certain results of the research I have done in cooperation with Hippenreiter, Ovchinnikova, and other of my associates at Moscow University.

This research was devoted to studying the features of human hearing.

Why did we, in the course of working on the problem of the biological and social, come to investigate such a special field as aural sensation? What was the idea behind our research?

To answer those questions I shall have to touch on the ideas and hypotheses that guided us.

There was first of all the idea that the evolution of the psychic functions and capacities specific to man is a quite specific process.

This process differs in principle both from that of the development of biologically inherited behaviour and from the process of the acquiring of individual experience.

The psychic functions and capabilities proper to man as a social being evolved and took shape in a quite specific form, namely that of a process of assimilation and mastery (or becoming proficient).

Let me try to explain what I mean by that.

During the history of human society men have travelled an immense road in the evolution of their psychic capabilities. The thousands of years of social history have done much more in this respect than the hundreds of million years of animals' biological evolution.

The achievements in the development of psychic functions and powers were accumulated gradually, of course, being passed on from generation to generation. That means that

they were reinforced somehow or other, otherwise they could not have developed progressively and at an ever accelerating rate.

But how precisely could these achievements be fixed and reinforced and passed on to the next generation? Could it have been done in the form of morphological, biologically inherited changes?

Not at all. Although biological inheritance also exists, of course, at the level of man, its action does not, however, extend *directly* to the advances that mankind has made in the course of the last 40,000 or 50,000 years in the sphere of psychic development, i.e. since the modern type of men was finally formed biologically and human society passed from prehistoric to historical development—a process that is entirely governed by the action of objective social laws.

From that moment men's achievements in the development of psychic power were fixed and passed on from generation to generation in a special form, namely in an external, objective, exoteric form.

This new form of accumulation and transmission of phylogenetic (or rather, historical) experience came into being because the activity characteristic of man is productive, constructive activity. It is, above all, the basic human activity—*labour*, *work*.

The fundamental, truly decisive importance of this fact was discovered more than 100 years ago. The discovery was made by the father of scientific socialism, Karl Marx.

Labour, implementing the process of production (in both the forms of the latter, material and intellectual), is crystallised in its product. That which is manifested on the part of the subject in unrest or movement (*Unruhe*) appears in the product in the form of 'a fixed quality without motion' or 'a fixed, immobile characteristic' (*ruhende Eigenschaft*), in the form of being or a material object.[1]

The process of this transformation can be regarded from

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[1] Karl Marx. *Das Kapital*, Vol. 1 (Dietz Verlag, Berlin, 1977), p. 195, *idem. Capital*, Vol. 1. Translated by S. Moore and E. Aveling (Progress Publishers, Moscow, 1978), p. 176; *idem. Capital*, Vol. 1. Translated by Ben Fowkes (Penguin Books, Harmondsworth, 1976), p 287.

various aspects and in various relations. It can be looked at from the aspect of the amount of expended labour power in relation to the quantity of product produced, as is done in political economy. But it can also be regarded from the aspect of the content of the subject's activity itself, abstracted from its other aspects and relations. Then the transformation of human activity into its product appears to us as a process of the embodiment of men's psychic features in the products of their activity, and the history of material and spiritual culture appears as a process that expresses the achievements of the development of the powers of the human species (*Menschengattung*).

The process of the historical development of hand tools and instruments, for example, can thus be considered *from this aspect* as expressed and fixed advances in the development of the hand's motor functions, a complication of the phonetics of languages (as an expression of improvement in articulation and of speech hearing), and progress in works of art (as an expression of the development of aesthetic powers).

Even in ordinary material industry we are faced with 'objectified' human capacities (*Wesenskräfte des Menschen*).

This idea has quite general significance for scientific psychology. Its meaning, however, comes out fully in analysis of the other aspect of the process, i.e. in considering it not from the aspect of the materialisation or objectification (*Vergegenständigung*) of human capabilities but from the aspect of its mastering or appropriation (*Aneignung*) by individuals.

Before the individual entering upon life there is not Heidegger's 'nothing', but the objective world transformed by the activity of generations.

But this world of objects embodying human capabilities and built up in the development of socio-historical practice is not given to the individual initially in *this* quality. For this quality, this human aspect of surrounding objects to be opened to the individual, he must perform overt activity in relation to them, activity adequate (though not, of course, identical) to that in which they are crystallised.

That also applies, naturally, to the objective ideal phenomena created by humanity, i.e. to language, concepts, and ideas, music, and works of the plastic arts.

The individual, the child, does not simply 'face' the

world of human objects. In order to live it must act overtly and adequately in this world.

But that is only one condition of the specific process that we call assimilation, appropriation, or mastering.

Another condition is that the individual's relations with the world of human objects should be mediated by his relations with people, and that these relations should be included in a process of intercourse. This condition is always present. For the notion of an individual, a child, who is all by itself with the world of objects is a completely artificial abstraction.

The individual, the child, is not simply thrown into the human world; it is introduced into this world by the people around it, and they guide it in that world.

The objective necessity for, and role of, intercourse in man's development have been quite well studied in psychology, and there is no need to go into them here.

Intercourse in its primary form, in the form of joint activity, or of oral communication, is thus a second *sine qua non* of individuals' mastering of the achievements of mankind's socio-historical evolution.

In order to bring out the sense of this process more fully I must point out that it is a process of reproduction by the individual of capabilities acquired by the species *Homo sapiens* during its socio-historical evolution. What is achieved at the level of animals through biological inheritance, is thus achieved by man through assimilation, i.e. by a process that is one of humanising the child's psyche. And I can only agree with the idea expressed by Pieron in his lecture on humanisation that a child, at birth, is a candidate for humanity; it cannot become human in isolation; but has to learn to become a man in contact with other men.[2]

Everything specifically human in the psyche is moulded in the child in fact during its life.

Even in the sphere of its sensory functions (such elementary ones, it would seem!) an important restructuring takes place whereby quite *new*, as it were, sensory powers arise, typical only of man.

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[2] See: Henri Pieron. Qu'est-ce que l'hominisation? In *Le Courier rationaliste*, monthly supplement to *Cahiers rationalistes*, 1959, 10: 211 (25 October).

We also made the moulding of new, specifically human capabilities in the sphere of aural perception the subject-matter of a detailed experimental investigation.

2

Articulated oral speech does not exist among animals; neither does music. The world of oral speech, and the world of music, are a creation of mankind.

In contrast to natural sounds, speech and musical sounds form definite systems with special generatrices and constants inherent only in them. These generatrices and constants must also be distinguished by man's hearing.

For speech sounds (I have in mind non-tonal languages) the main generatrices and constants are, as we know, specific timbres, in other words the characteristics of their *spectrum*. Conversely, their main frequency does not have a sense-differentiating function and we ordinarily pay no attention to it when perceiving speech.

It is a different matter with musical sounds. Their main generatrix is pitch, while their constants lie in the sphere of pitch relations.

Speech hearing proper is basically the hearing of timbre, but musical hearing is that of tones, based on ability to distinguish pitch and pitch relations from the sound complex.

We were concerned precisely to study this capability in our laboratory.

We began with a very simple task; we wanted to measure our subjects' thresholds for distinguishing the pitch of two consecutively produced sounds. Here, however, we came up against an essential difficulty, which was that it was necessary, for successful measurements of this kind, for the sounds to be compared only for the desired parameter (in our case by the fundamental frequency). As has often been found, however, any sound, even a sinusoidal one obtained by means of an electric generator, is perceived, for definite physico-physiological reasons, as having a timbre colour that alters with change of pitch. High sounds, for example, are thus perceived as 'lighter' and low ones as 'darker' or 'heavier'.[3] For our purpose, therefore, we could not limit

[3] See: Carl Stumpf. *Tonpsychologie*. Vol. I (Hirzel, Leipzig, 1883), Vol. II (1890); W. Köhler. Akustiche Untersuchungen. III. *Zeitschrift für Psychologie und Physiologie der Sinnesorgane*, Abteilung. *Zeit schrift für Psychologie* (Leipzig, 1915), *72*, 1—2.

ourselves to employing the classic method of measuring the thresholds of tonal hearing. We had to find a new technique that would fully exclude any possible influence on evaluation of the fundamental frequency of the sounds being compared by their inevitably altering micro-timbres.

We succeeded in developing such a technique.[4] It consisted in our presenting for pitch comparison two consecutive sounds of a *different* spectral composition. One of them (the constant) was close in its spectrum to the Russian vowel [у] (oo), the other (the variable) was similar to a sharp [и] sound (the Russian vowel [и]='ee').

The length of the sound was one second, the interval between the sounds compared half a second. The level of intensity was 60 decibels. The experiment was carried out along the lines of the 'technique of constant stimuli' in frequency zones from 200 to 400 Hz.

The method described (I shall call it 'comparative') faced the subject with a very special task, to wit: to compare the Russian sounds [у](oo) and [и](ee) only according to their basic frequency, ignoring their spectral composition.

This task, characteristic of musical hearing, is the opposite, in a certain sense, of that which is specific for speech, timbre hearing.

We employed this method after measuring thresholds by the classic technique, i.e. by comparing the pitch of monotimbral sounds. We thus obtained two thresholds for each subject: one by the ordinary method and the other by the technique we proposed.

The first threshold I shall call the differential one, as usual, and the second the 'threshold of discrimination'.

We began by measuring both thresholds in 93 adult subjects aged 20 to 35.

Some of the results we obtained in this first series of tests were as follows.

All our subjects fell into three groups.

In the first group (13 per cent) the transition to experiments with sounds of different timbre did not cause any change of threshold.

In the second, biggest group (57 per cent) the threshold of

[4] See: J. B. Hippenreiter. Analysis of the Systemic Structure of Aural Perception. A Contribution to the Technique of Measuring Sensitivity to Differences of Pitch. *Doklady APN RSFSR*, 1947, 4: 113-118.

discrimination rose compared with the differential threshold.

Finally, subjects of the third group (30 per cent) proved unable to solve the problem of comparing the sounds [у] and [и] by their fundamental frequencies: the [и] sound was *always* perceived by them as higher, even when it was objectively more than an octave lower than the [у] sound. And that after careful explanations of the test and many demonstrations!

The subjects of this group thus displayed a kind of tone deafness, a phenomenon that was completely masked when the classic method of measuring thresholds was used, which indicates that there was no co-ordination between the magnitude of the thresholds measured by the two methods.

In the tests with the classic techniques the subjects in the third group obviously did not compare sounds by their fundamental frequency (i.e. by their *musical* frequency) but by their aggregate characteristic, which included microcomponents of timbre that were apparently dominant for them.

Let us now turn to the subjects of the first group, among whom there was no rise in thresholds when passing to evaluations of the pitch of sounds [у] and [и]. They were subjects with a good ear for tone. In fact, when we gathered additional information about our subjects, it turned out that those in this group displayed a certain musicality.

The second group occupied a place intermediate between the other two. Some of the subjects in it had thresholds of discrimination less than double the differentiation thresholds which suggests a satisfactory development of their ear; some subjects' thresholds of discrimination were many times higher than the differentiation thresholds, i.e. they came close to the tone deaf group.

Such were the results of our first tests.[5] They raised a number of questions to which we devoted further research.

3

First and foremost there was the question of what was the reason for absolute pitch not being formed in a considerable number of our subjects.

Assuming that an ear for timbre is formed during the mastery of speech, and an ear for tone during the learning

[5] J. B. Hippenreiter. *Op. cit.*

of music, we suggested the following hypothesis: if an infant very early masters a basically timbre language, which would necessarily lead to rapid development of a verbal hearing of timbre, then obviously the formation of an ear for tone proper could be delayed. That was the more probable in that a highly developed verbal ear is capable, to some extent, of compensating a lack of development of a musical ear. If the life of a given individual, therefore, so matures that tasks requiring the distinguishing of the fundamental frequency in sound complexes are not subsequently presented to him as ones of interest, he will not develop a musical ear (hearing of tones) and will remain tone deaf.

Could we test that hypothesis, even though indirectly?

We tried to do so, arguing as follows. If our hypothesis was right, then there would not be tone-deaf individuals among our subjects whose mother tongue was a *tonal language* (i.e. a language in which purely tonal elements have a sense-differentiating function), for assimilation of the mother tongue would simultaneously have trained an ear for tone in them as well.

In fact, experiments carried out with 20 Vietnamese (the Vietnamese language is tonal) gave the following results: in 15 of the 20 subjects the transition to comparing sounds of different timbre either did not raise the threshold at all, or caused a slight raising of it; in only five of the subjects was there a more considerable raising of the threshold; four of them, however, proved to be from central areas of Vietnam where the population speak a language with a less expressed role of tonal elements. *We did not find one case of tone deafness or a very steeply raised discrimination threshold in this group.*[6]

These results, incidentally, accord quite well with the fact noted by Taylor (in Capetown). According to him tone deafness (in the absence of physiological defects), which is fairly common in Britain and America, is virtually unknown among African tribes whose language 'makes extensive use of intonation of the voiced sounds.'[7]

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[6] See: A. N. Leontyev and J. B. Hippenreiter. *Analysis of the Systemic Structure of Aural Perception*. Communication VIII. The Influence of Mother Tongue on the Training of Hearing. *Doklady APN RSFSR*, 1959, *2*: 59-62.

[7] J. Taylor. Towards a Science of Mind. *Mind*, 1957, *66*, 264: 449.

The results of our experiments with Vietnamese did not yet, of course, provide direct evidence for our hypothesis. But how could it be shown *directly* that sense capacities corresponding to the world of phenomena created by society were not innate in man but formed during his life through assimilation of these phenomena? Obviously, it could be done in only one way—by trying to train such a capacity in the laboratory. That is the line we took.

4

In order to mould the process we had first of all to imagine its structure and physiological mechanism.

At the present time, there are (as we know) two points of view on the general mechanism of sensory processes. One, the older, is that sensation is the result of the transmission of excitation arising in a receptor organ to sensory zones. With the other, opposite point of view, substantiated in the nineteenth century by the eminent Russian physiologist Sechenov, the structure of sensory processes must also include motor acts with their proprioceptive signalling. We adopted this point of view. That is why Köhler's idea, expressed in 1915, that there is an intimate link between excitation of the auditory nerve and innervation of the organs of vocalisation, caught our attention.

Basing ourselves on this idea, on a number of contemporary investigations, and on certain observations of our own, we undertook to investigate the role of the vocal motorium in differentiating the fundamental frequency of sounds.

We continued the experiments with our subjects and measured their threshold of 'exact vocalisation' (intoning) of a given pitch in the appropriate range for each of them. I will not dwell on the equipment we used in these experiments, except to note simply that the measurements were controlled by an oscillograph.

We found, from these measurements, that there was a very high correlation between the magnitude of the threshold for distinguishing the fundamental frequency and the mean error in vocalising it: $\rho=0.83$, with $m_\rho \pm 0.03$.

What does this link express? Does the accuracy of intoning depend on the precision of distinguishing the funda-

mental frequency or, on the contrary, does the accuracy of the distinguishing depend on the accuracy of intoning?

The following experiments gave us the answer to that. We repeated the experiment with subjects who had an undeveloped musical ear by a comparable method, with one addition. We asked them to intone loudly (sing aloud) the pitch of the sounds presented to them.

It proved, as a result, that, with all subjects, inclusion of vocalisation lowered the discrimination thresholds each time.

Let me give two very striking examples.

First, here are the results obtained with Subject 59, who was in the second, intermediate group. (I shall give the magnitude of thresholds in cents, i.e. in units of the musical logarithmic scale equal to 1/200th of a tone.)

First experiment (without intoning): the discrimination threshold was 385 cents.

In the second experiment intoning was introduced and the threshold fell more than fourfold to 90 cents.

Third test (without intoning): threshold 385.

Fourth test (with intoning): threshold again 90.

Finally, in a fifth test (without intoning), the threshold of the experiment rose to 335 cents.

Now let us take the second example, of Subject 85, who was in the group of the tone deaf.

In the first, third, and fifth tests, which were made without intoning, this subject could not judge the relative pitch of sounds of various timbre correctly, even with a difference between them of 1200 cents.

In the tests with intoning, i.e. the second and fourth, he was able to compare sounds by their fundamentals, and his thresholds proved to be 135 cents (which, in the zone of 300 Hz, is around 22 Hz).

Inclusion of vocal activity (intoning) in the process of perceiving the fundamentals of sounds yielded a distinct lowering of the discrimination of thresholds.[8]

To test this point we made several control and additional experiments. They fully confirmed our conclusion about

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[8] J. B. Hippenreiter. *Analysis of the Systemic Structure of Aural Perception.* Communication II. Experimental Analysis of the Motor Basis Underlying the Perception of Pitch. *Doklady APN RSFSR*, 1958, *1*: 47-50.

the decisive role of the vocal apparatus's activity in distinguishing fundamental frequency.[9]

From there we passed to experiments in active ear *training* in those subjects in whom a capacity to hear tones had proved to be unformed.

The subjects we used, of course, had various peculiarities and, to the point, a different initial level. There were those among them, first of all, who could not 'tune' their voices correctly enough to the standard sound made by the electric generator. We began by trying to 'organise' this process in them. The experimenter, when pointing out wrong intonation to a subject, encouraged his attempts to alter the pitch of the sound in the correct direction, and of course noted the moment when the pitch of the vocalised sound coincided with that of the standard. This 'setting up' usually took from two to six sessions. Such 'training' tests were carried out altogether with 11 subjects.

The general result of the tests was that after them discrimination thresholds fell steeply, especially when the subjects began to tune their voices without mistake.[10]

Here are some examples.

Subject 2: discrimination threshold before the tests—690 cents; after the tests 60.

Subject 7: before the tests 1105 cents, afterward 172.

The case of Subject 9 was interesting. His initial threshold was also very high—1188 cents. Although he succeeded in tuning his intoning, his threshold still proved to be very high, above 1000 cents. When, however, the experimenter suggested that he use his ability to sing their pitch loudly, when comparing sounds, the threshold immediately dropped $5^1/_2$-fold.

Such cases are interesting in this respect, that they enable us to distinguish yet another moment in the training of musical ear. It is not enough, as we see, for the subject to be able to tune his voice to the perceived sound; it is also necessary for this process to be included in the act of perceiving pitch. This is always possible with a direct

[9] See: O. V. Ovchinnikova. *Analysis of the Systemic Structure of Aural Perception.* Communication III. On the Effect of Involving the Vocal Chords in the Evaluation of Pitch in Sound Differentiation. *Doklady APN RSFSR*, 1958, *1*: 51-54.

[10] See: O. V. Ovchinnikova. The Training of Ear by the 'Motor' Method. *Doklady APN RSFSR*, 1958, *2*: 55-60.

requirement of singing aloud perceived sounds that are within the subject's singing range.

The next step in training tonal hearing is to pass to distinguishing pitch without *loud* singing, silently, and when the sounds being perceived lie outside the subject's singing range.

As an example I would cite Subject 9, mentioned above, whose threshold fell only when he sang loudly. Later we obtained a steep lowering of threshold, which had initially been above 1000 cents, and that with suppression of loud singing.

The main technique that we used in order to transfer subjects to this next stage was the following.

As soon as the voice was fully 'tuned' to the pitch of the standard sound and the subject included loud singing in the process of comparing sounds by pitch, we suggested that he start vocalising the pitch only after transmission of the standard sound had ceased. We thereby (analysis indicated) did not simply exclude vocal action altogether at the moment of hearing the sound, but only retarded it, converting it into an act of preliminary soundless *tuning* of the vocal apparatus to the pitch of the standard.

The orienting function (what is the pitch?) was thus separated from the process with the character of a performing act ('to sing the given pitch').

The process of this change of function of the vocal motorium proper also constitutes the main moment in ear training. At the same time it is an act of engendering a capacity for active representation of pitch, which, as Teplov's outstanding research into musical abilities has shown, is always connected with the inner vocal motor apparatus.[11]

We can thus say that the attempt we planned succeeded: *we managed to train a capacity to distinguish musical pitch properly* in subjects who had been unable to do so.

Were we right, however, when we related the effect obtained unconditionally to the inclusion of vocal activity in the perception of sounds? For it is known that the threshold of differentiating pitch is also much improved by simple training on sounds of one timbre.

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[11] See: B. M. Teplov, *Psikhologiya muzykal'nykh sposobnostei* (The Psychology of Musical Abilities), Moscow-Leningrad, 1947.

Taking that into consideration we undertook another series of experiments.

We began persistently to train a group of subjects to differentiate the pitch of simple sounds. Like other workers, we obtained a marked lowering of the threshold on the same sounds as a result. As for the discrimination threshold, measured before and after this purely 'sensory' training, it proved not to be altered at all in seven cases out of nine; in two cases, although it was lowered, it was only slightly so.[12]

The conclusion from that is obvious: without development of vocal activity proper and its inclusion in the receptor system, musical ear is not trained.[13]

5

In the course of the experiments described we got a chance to picture the mechanism itself of tonal hearing in more detail.

In order to distinguish pitch, not only must the action of the sound complex on the organ of hearing evoke an unconditioned-reflex, orientive and adaptive reaction, but the vocal apparatus, too, must be active.

Can this activity, however, arise by the mechanism of a simple sensorimotor act?

That cannot be assumed, because *before* the inclusion of outward or inward intoning, the fundamental was not distinguished in the sound complex, as we have seen.

In other words, intoning does not simply reproduce perception but becomes part of the internal, intimate mechanism of the process of perception itself. It performs a function of active orientation, distinguishing and relative appreciation in regard to musical pitch.

We tried to trace the dynamics of this process. For that purpose we recorded the frequency of the standard sound on one channel of the oscillograph when measuring the dis-

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[12] See: O. V. Ovchinnikova. *Analysis of the Systemic Structure of Aural Perception*. Communication VI. A Propos of 'Sensory' Training of the Hearing of Pitch. *Doklady APN RSFSR*, 1959, *1*: 79-82.

[13] See: O. M. Leontyev. The Structure of the Human Aural Function. *Pitannya psikhologii*, *Naukovi zapiski*, *Ministerstvo Osviti URSR*, Vol. 11 (Radyans'ka shkola, Kiev, 1959), pp 13-21.

crimination threshold, and the frequency intoned by the subject on another channel.

The high rate of movement of the film on which the record was made enabled us to measure the intoned frequency over very short successive time intervals (10 metres a second each).

Processing of the data obtained in tests on 40 subjects showed that the frequency of intoning only gradually approximated to that of the affective sound. In some cases a considerable interval (of 100 Hz or more) was observed, in others a much smaller one (e.g. 40 Hz or even only 10 Hz). There also proved to be a time difference in becoming 'tuned' to the frequency of the affective sound (from 1.0 to 0.1 second).

The main phenomenon, however, was that as soon as the intoned frequency came close to that of the operative sound, it immediately became stabilised.[14]

In order to clarify this process we asked subjects whose hearing of pitch was already sufficiently moulded to intone the estimated pitch of the sound made by the electric generator. We recorded the frequency of the generated sound on one channel of a loop oscillograph and the frequency of the intoned sound on another channel; a luminous marker recorded time intervals on the film. The tests were made on 40 subjects.

Because the fast-moving film enabled us to take changes in time intervals of a hundredth of a second into account, we could follow the studied process as if under a microscope.

The results obtained suggested that the intoned sound was never immediately fixed at the given pitch even in subjects with a relatively good ear, but approached it gradually.

The intoning and process of voice tuning took quite a long time (of the order of one or two seconds) in subjects who were at a lower level of development. This had a kind of 'trial and error' or 'probing' character, i.e. the intoned pitch was altered now toward a raising, now toward a lowering until the moment it coincided with the given pitch, when it was stabilised. In subjects of a higher grade this process had the character of a brief 'attack', i.e. proceeded

[14] See: A. N. Leontyev and O. V. Ovchinnikova. A Propos the Mechanism of the Hearing of Pichh. *Doklady APN RSFSR*, 1958, 3: 43-48

in one direction in intervals of 10 to 40 Hz and took only a few hundredths of a second altogether.

We must also, finally, note another circumstance, namely that the general direction of search did not always, but only generally, go from a lower to a higher frequency. When the given sound was lower than the range 'comfortable' for intoning, we also observed cases of movement in the opposite direction.

Allowing for these and certain other facts, we can picture the mechanism of tonal hearing as one that works not on a pattern of 'filter' analysis but on the pattern of the 'comparator' described by Mackay.[15]

This pattern provides for incoming signals to be evaluated by stimulating 'an "initiative" internal response-mechanism, designed to adapt its activity to match or counterbalance internally what is received'.[16]

According to this scheme, the mechanism for comparing two sounds by pitch may be described as follows: as soon as the process of intoning was tuned to the frequency of the first of the sound stimuli being compared, and was stabilised, the effect of the second stimulus again evoked a change in it, now toward coincidence with the frequency of the second stimulus. When it altered toward arising frequency the second stimulus was perceived as higher but with a change in the opposite direction as lower. The degree of the change itself probably underlies appreciation of the magnitude of the interval.

6

It remains for me to describe our last experiments, the idea of which was to create perceptive functional systems in the laboratory such as are not formed in ordinary conditions.

We considered that only thus could our hypothesis be given decisive experimental proof.

We set ourselves two objectives.

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[15] D. M. Mackay. The Epistemological Problem for Automata. In: E. Shannon and J. McCarthy (Eds.) *Automata Studies* (Princeton U. P., Princeton, N. J., 1956), pp 236-237.

[16] *Ibid.*, p. 237.

One was to substitute another receptor organ for the auditory organ in the mechanism of tonal hearing, while the effector apparatus distinguishing frequency (i.e. the apparatus of intonation) was to retain its function.

What receptor could be substituted for hearing? Obviously, only one that responded to stimuli possessing a frequency parameter.

The organs of *vibrational sensations* are such receptors.

The perception of mechanical vibration has a very important feature for us: a change in its other parameter, intensity (amplitude) affects the perception of frequency. The greater the amplitude the lower the frequency seems, and vice versa.[17] When subjects are comparing vibrational stimuli by frequency, therefore, they usually orient themselves properly speaking not on their frequency but on the difference in their integral, 'total' quality. We could thus also employ our 'comparator' method to measure changes in the thresholds of vibrational sensitivity. The conditions of the experiments were as follows: vibrations of the rod of a noiseless vibrator were applied to the end of the index finger (with an area of contact around 1.5 mm in diameter). Measurements were made in the frequency band between 100 and 160 Hz; the ratio of amplitudes in the measuring of discrimination thresholds was 1:2. The frequency and amplitude of the stimuli were continuously controlled by apparatus.

At first we measured the differential thresholds for stimuli with the same amplitude. Then, by comparing the frequencies of stimuli with different amplitudes, we measured discrimination thresholds. As was to be expected, the latter were always two to four times as high as the differential thresholds.

The objective of the next experiments was to involve the activity of the subject's *vocal apparatus* in the process of perceiving the frequency of *mechanical vibration*, along the lines of the 'comparator' scheme already described.

All the subjects who took part in the tests had a quite good musical ear.

The tests were performed in the same order as those for hearing. At the same time the forming of this new perceptive

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[17] See: Georg von Békésy. Similarities between Hearing and Skin Sensations. *Psychological Review*, 1959, *66*, 1:3.

functional system differed in several respects. The main difference was that the most difficult stage was that of 'tuning' vocalisation (intoning) of the frequency of the influencing vibrations. This task seemed unexpected, 'unnatural', to the subjects at first, and to some even impossible. The involving of vocalisation in the task of comparing vibrational stimuli was also more difficult and required a considerable number of trials.

By employing certain additional procedures these difficulties were surmounted. As a result the threshold for distinguishing the frequency of mechanical vibrations fell steeply.[18]

Here are the figures.

Subjects 1 and 2: initial threshold of discrimination (in cents)—700; after the tests 246, i.e. almost 66 per cent lower.

Subject 3: initial threshold 992; after the tests 240, i.e. 75 per cent lower.

Subject 4: initial threshold 1180; after the tests 246, i.e. nearly 80 per cent lower.

Thus a new functional system was built up and began to 'operate'!

Parallel with the experiments described, which were carried out in our laboratory by Chumak, yet another series was mounted. Their objective was, on the contrary, to introduce another 'comparator' into the perceptive functional system without altering the receptor, i.e. to introduce another effector apparatus, viz., the tonus of the muscles of the arm.

This task proved more complicated.

It required special apparatus and, the main difficulty, very long work with each subject.

The experiments were made with individuals who were very markedly tone deaf.

An instrument of original design was introduced into the set-up. Pressure on the key of this instrument, which remained almost immobile, caused a smooth change in the generated frequency which was transmitted to a frequency meter, oscillograph, and telephone (see Fig.13).

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[18] See: A. Ya. Chumak. *Analysis of the Systemic Structure of Aural Perception.* Communication X. Experiment in Training Differential Vibrational Sensitivity. *Doklady APN RSFSR*, 1962, 3: 83-86.

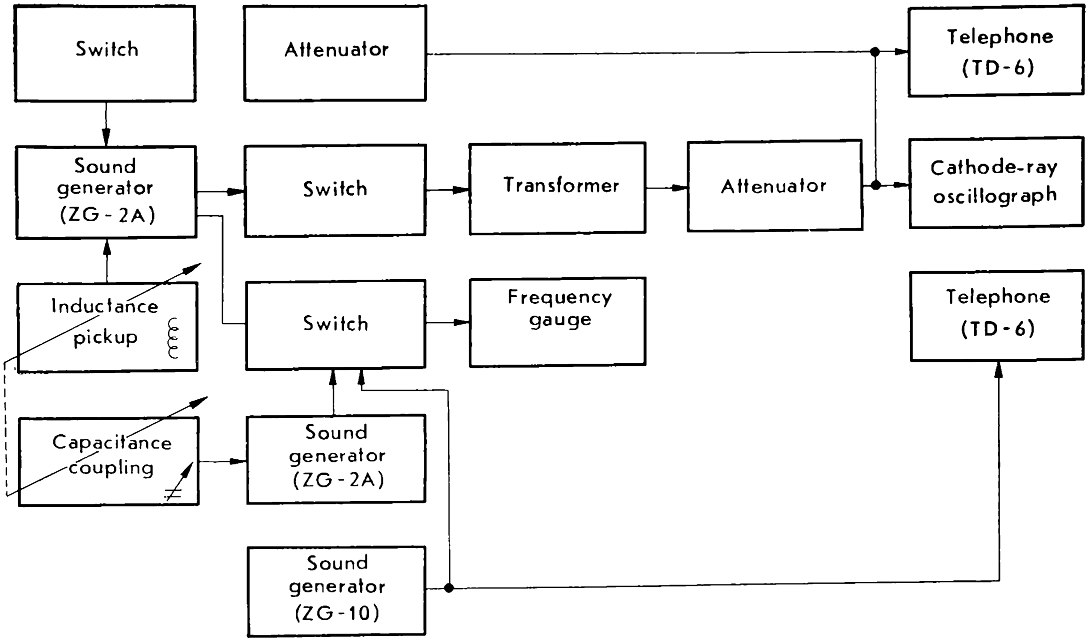

Fig. 13. Flow sheet of an experimental set-up.

The strength of the pressure on the key was linked (within given limits) by a direct linear dependence with the frequency generated by the instrument; that enabled us to express it conventionally in the number of vibrations generated per second, i.e. in hertz.

The objective in the first stage of the work was to form a conditioned link between the frequency of the influencing sound and the degree of static force of the muscles of the arm. Three subjects took part in the tests.

A pure tone (100 to 500 Hz) was presented to the subject, to which he was to react by pressure of his hand. The experimenter evaluated each response, reinforcing cases when the pressure coincided with the frequency of the sound conditionally associated with it. The subject himself did not hear the sound generated by the instrument.

As a result of these tests, which lasted for 25 to 33 sessions of 40 minutes each, a conditioned link 'pitch degree of muscular effort' was formed in all the subjects.

Comparison of the average error of the muscular reaction after the first session and at the end of the experiments yielded the following figures (in conventional units): K.—65 and 1; B.—65 and 5; L.—25 and 10.

We established, furthermore, that with transition to sounds of other timbres ([y], [и], [a], i.e. Russian vowel sounds), the audio-proprioceptor link was fully preserved.

This important phenomenon indicated that the muscular reaction and its proprioceptor signalling were in fact linked with the sound's fundamental frequency. But had our subjects' muscular stress acquired the function of discriminating pitch?

In order to answer that we measured the threshold of discrimination and obtained the following results:

K.—threshold of discrimination before the tests 1994 cents, afterward 700;

B.—before 1615 cents, afterward 248;

L.—before 828 cents, afterward 422.

Thus the threshold of discrimination was lower after the tests, *although the subjects were not exercised in differentiating pitch during these experiments*. We were therefore inclined to explain the lowering of thresholds by the subjects' mechanism of perception having involved a link between pitch and degree of muscular effort.

In addition we would draw attention to the point that,

with the high accuracy of conditioned muscular reactions attained by the subjects, the lowering of the threshold of discrimination in two of them (K. and L.) was not very great, only halved.

How was this phenomenon to be explained?

We got the impression that the functioning of the associations formed was weakened in these subjects with the transition to the more complicated task of comparing sounds of different timbre. We therefore continued the experiments with them. In the end it proved that, although the accuracy of their muscular effort was not essentially altered, the threshold of differentiation nevertheless fell markedly.

K.'s discrimination threshold, for instance, was lowered sixfold and L.'s almost ninefold.

I attach great significance to that fact.

Analysis indicated that as soon as the 'carcass' of the functional system was built, it had to undergo another transformation. As a result of this latent inner transformation its previous 'executive' function was fully replaced by an orienting, reflective one, and the whole system interiorised.

It remains for me to deal with the last point: can we maintain that such an artificial mechanism of tonal hearing was built up in our subjects, in which the role of the vocal apparatus was performed by the muscles of the arm?

I would answer that with the results of the control experiment.

During measurement of our last subjects' discrimination thresholds, we loaded the muscular apparatus of the arm in one case and the vocal apparatus in another. It proved that the first case undoubtedly upset their discrimination of pitch while the second did not cause any noticeable changes in the process.

We can thus consider that we also succeeded in forming this second functional receptor system.[19]

This functional system, just like that described above, is *only* a laboratory product, of course. It can function apparently only in the conditions of relatively simple tasks.

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[19] See: O. V. Ovchinnikova. *Analysis of the Systemic Structure of Aural Perception*. Communication IX. Experiment in Substituting a Motor Link in the System of Hearing Pitch. *Doklady APN RSFSR*, 1960, 3: 79-86.

This limitation of artificial systems is due to their being formed on the basis of inadequate morphological elements. But our experiments did not pursue the aim of demonstrating the possibility of creating capacities not normally proper to man. Their aim was simply to check experimentally the mechanism of the formation of perceptive functional systems.

7

I shall not give a resumé of the results of the experiments described, but will pass on directly to the conclusions.

Old scientific views invariably associated one psychic capacity and function or another with the existence of corresponding specialised, biologically inheritable brain structures. That idea was also extended to capacities that arose during man's socio-historical development.

The scientific point of view, of course, necessitates recognising that *any* psychic function is the result of the work of a definite organ or organs.

On the other hand, as I have already said, capacities and functions corresponding to specifically human acquisitions cannot be reinforced morphologically.

This antithesis forced us to put forward the idea that specifically human capacities and functions are built up in the course of the individual's assimilation of the world of human objects and phenomena, and that their material substratum consists of stable systems of reflexes built up during the individual's life.

Although we find that complex functional reflector systems are also formed in animals, only in man do they become permanent functional organs of the brain built up ontogenetically. That is a fact of the greatest importance.

The research described here applies to the forming of functional organs only of one, relatively elementary type. The moulding of those brain systems that, for example, perform acts of 'judging' *(Einsicht)* logical or mathematical relations, follows a different course. All the same, as the findings of the aggregate of the research available to us indicate, certain features can be singled out that are common for all ontogenetically established functional organs.

Their first feature is that, once formed, they then function as a single organ. The processes that they effect, therefore, seem, from the subjective, phenomenological angle, to be manifestations of elementary innate capacities. Such, for example, are the processes of directly grasping spatial, quantitative, or logical structures ('gestalts').

Their second feature is their stability. Although they are formed through the closing of cerebral links, these associations do not fade, like ordinary conditioned reflexes. Suffice it to say, for example, that the capacity to visualise tangibly perceptible forms, which takes shape (as we know) ontogenetically, does not fade after several decades' loss of vision, although naturally no reinforcing of the corresponding links is possible in conditions of blindness. This fact has recently been demonstrated both clinically and by means of Zemtsova and Novikova's electrophysiological technique.[20]

A third feature of the functional organs with which we are concerned is that they are formed differently than simple chains of reflexes or 'dynamic stereotypes'. The associations constituting them do not simply trace or copy the sequence of the external stimuli but unite independent reflex processes *with their motor effects* in a single complex reflex act. These 'compound' acts at first always have developed, external motor components that are then inhibited, while the act as a whole, in changing its original structure, is curtailed and made more and more automatic. As a result of these successive transformations a stable constellation also arises that functions as an integral organ, as allegedly innate capacity.

Finally a fourth feature consists in the point, as was specially emphasised by our last series of experiments, that, while corresponding to one and the same task, they may have a different structure, which explains the almost unlimited capacity for compensation that has been observed in the sphere of the development of specifically human functions.

I think that introduction of the concept of functional organs in the sense indicated above helps transplant the

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[20] See: M. I. Zemtsova. *Puti kompensatsii slepoty v protsesse poznavatel'noi i trudovoi deyatel'nosti* (Ways of Compensating Blindness during Cognitive Activity and Work), Moscow, 1956.

problem of the biological and social in man's psychic processes to the soil of precise laboratory experiments. I think, furthermore, that the systematic research begun into the forming of these organs and the capacities corresponding to them already enables us to draw several important general conclusions.

The main conclusion is that man's biologically inherited qualities do not govern his psychic capacities. Man's capabilities are not virtually contained in his brain. Virtually the brain includes not certain, specifically human capacities of some kind or another, but only *the capacity to form these capacities.*

In other words, biologically inherited qualities constitute only one of the *conditions* in man for the moulding of his psychic functions and capacities, conditions that of course play an important role. Thus, although these systems are not governed by biological qualities, they depend, for all that, on them.

Another condition is the world of objects and phenomena around man created by countless generations of people in their work and struggle. This world also makes man truly human. If, for instance, we differentiate between the form of his higher nervous processes, on the one hand, i.e. the purely dynamic features that depend on their morphological 'texture', and their content on the other hand, i.e. the function performed by them and their structure, we can then say that the former are determined biologically and the latter socially. There is no need here to emphasise that the *content* is decisive.

The process of mastering and assimilating the world of objects and phenomena created by men during the historical development of society is also the process in which specifically human capacities and functions are formed in the individual. It would, however, be an enormous error to imagine this process as a result of the activity of consciousness or of the effect of 'intentionalism' in the sense of Husserl and others.

Assimilation occurs during the development of the subject's *real* relations with the world. These relations, moreover, do not depend on the subject, or on his consciousness, but are governed by the specific, historical, social conditions in which he lives, and by how his life is moulded in these conditions.

That is why the problem of the outlook for the psychic development both of man and of mankind is first and foremost one of a just and rational structure of the life of human society, i.e. the problem of what structure of it will give every person the *practical* possibility to master the achievements of historical progress and to take part creatively in multiplying these achievements.

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I chose the problem of the biological and social because there are still views that affirm a fatalistic conditioning of people's psyche by biological inheritance. These views spread ideas in psychology of racial and national discrimination, and the right to genocide and destructive wars. They threaten mankind's peace and security, and they are in flagrant contradiction with the objective findings of scientific psychological research.

AN OUTLINE OF THE EVOLUTION OF THE PSYCHE

II

I. The Evolution of the Psyche in Animals

1. Stages in the Elementary Sensory Psyche

The origin of sensitive living organisms is associated with complication of their vital activity. This complication consists in a differentiation of the processes of external activity that mediate organisms' relations with those properties of the environment on which maintenance and development of their life depend. The differentiation of these processes is due to the development of irritability to effects that perform a signalling function. So a capacity arises for organisms' reflection of the effects of surrounding reality in their objective connections and relations, i.e. *psychic* reflection.

These forms of psychic reflection are developed along with complication of the organisms' structure and depending on the development of the activity together with which they originate. Scientific analysis of them is therefore impossible other than on the basis of a survey of the activity of animals itself.

What then is the activity of animals with which the simplest form of their psyche is associated? Its main feature is that it is induced by some property or another affecting the animal to which it is at the same time directed, but which does not coincide with the properties that the animal's life *directly* depends on. It is governed, consequently, not by the affecting properties in themselves but rather by them in their relation with other properties.

We know, for example, that as soon as an insect gets caught in a spider-web, the spider immediately moves toward it and begins to enmesh it with its thread. What is it that causes this activity of the spider's, and to what is it directed? To answer that we have to exclude various mo-

ments one after another that might possibly affect the spider. It has been established experimentally in that way that what stimulates the spider's activity, and that to which it is directed, is the vibration produced by the wings of the insect that is transmitted along the spider-web. As soon as the vibration ceases, the spider stops moving toward its victim. It is enough, however, for the insect's wings to begin vibrating again, for the spider to move toward it again and once more enmesh it in its web. Is it, however, in fact the vibration that evokes the spider's activity and at the same time to what this activity is directed? This is demonstrated by the following experiment. A resonating tuning fork is attached to the spider-web. In response the spider runs to the tuning fork, climbes on to it, spins a web around it, and tries to strike it with its mandibles (Rabaud[1]). This means that it is a matter here of the fact of vibration; for, apart from vibration, there is nothing in common between a tuning fork and an insect that has become trapped in a spider-web.

Why is the spider's activity associated precisely with the effect on it of vibration which in itself, of course, plays no role in its life? Because, in normal conditions, the effect of vibration has a certain association, a certain stable relation with the nutrient matter of the insect that has been caught in the web. We shall call this relation of an influencing property to satisfaction of a biological need the *biological sense* of this influence. Employing this term we can say that the spider's activity is directed to a vibrating body because the vibration has acquired a sense of food for it in the course of the species' evolution.

The biological sense of any influence is not constant for an animal, but on the contrary varies and develops during its activity in accordance with the objective associations of the corresponding properties of the environment.

If, for example, a hungry toad is first systematically fed with worms and then an ordinary matchstick and round bit of skin put in front of it, it will pounce on the matchstick, which has an elongated form like worms, and not touch the skin; elongated form has acquired the bilogical sense

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[1] See: Etienne Rabaud. La biologie des insectes, avant, pendant, après. J.-H. Fabre. *Journal de psychologie normale et pathologique*. 1924, 8: 705-729.

of food for it. If, on the contrary, we feed the toad first with spiders, it will then pounce on the skin, similar in shape to a spider, without touching the matchstick; the round form of the object has now acquired the sense of food for it.

The sense connections that arise in the activity of animals, it must be noted, are conditioned reflexes with a specific, and (one can even say) extraordinary character. They differ markedly from the conditioned associations that form the mechanism of *behaviour* itself, i.e. connections by which behaviour is realised.

When an animal, seeing food, moves toward it, i.e. when we are concerned with the sense association 'sight of food—food', this association arises and changes quite differently from those that arise in it, for example, during the formation of a habit of avoiding obstacles in its path (an association 'obstacle—by-passing movement').

Links of the first kind are formed very quickly, as research has shown, from 'scratch', and are broken down just as quickly; one or two combinations are sufficient for that.

Links of the second kind arise and fade slowly, on the contrary, and gradually. Chicks, for example, already begin to peck selectively at chopped egg yolk after a single success. For two-day-old chicks it is sufficient to peck once or twice at a bit of bitter orange peel instead of egg yolk for its food behaviour toward yolk to be wiped out (Morgan *et al*). On the other hand, it takes dozens of trials to develop a quite satisfactory adaptation of pecking movements in chicks to the external conditions in which they are given food.

Buytendijk, studying the forming of habits in toads, gave one of these animals, in one of a series of his experiments, insects whose substance caused a sharp negative biological reaction.[2] A single experience was enough for the toad to refuse for many hours afterward to try and eat these insects, or any other outwardly resembling them. In other experiments he separated the bait (an earthworm) from the toad by glass; in those conditions, the toad on the contrary, displayed great persistence, in spite of its striking the glass each time; it made many attempts before its reaction faded. Even intensifying the moment of 'pun-

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[2] See: Buytendijk. *Vue sur la psychologie animale* (Payot, Paris. 1930).

ishment' (negative reinforcement) did not stop movements in such cases. In Abbot's experiments the frog continued for 72 hours to pounce on bait surrounded by needles, until the skin of its upper jaw was seriously lacerated. The biological significance of the difference in rate of formation of both kinds of association is quite understandable if we allow for the species' life conditions. If a toad (Buytendijk says) approaches an ant-hill during its evening hunt and catches a poisonous ant, the rapid formation of an association protects it from swallowing other such insects harmful because of the acid they have. When a toad, on the contrary, tries to catch an earthworm but does not succeed in doing so, a second attempt may help it all the same, in ordinary circumstances, to get food.

Another feature of sense connections is their sort of 'bilateral' character, which is expressed not only in the effect of a given stimulus beginning to evoke a certain reaction, a certain behaviour, as a result of the forming of such a connection, but also in a corresponding need now to 'recognise itself' as it were in the object-stimulus, to be concretised in it, and to evoke active, search activity in relation to it .

Darwin had already stressed the special nature of these sense links, in citing, for example, the following observations:

> Thus it is asserted that if a calf or infant has never sucked its mother, it is very much easier to bring it up by hand than if it has sucked only once. So again Kirby states that larvae after having 'fed a time on one plant, will die rather than eat another, which would have been perfectly acceptable to them if accustomed to it from the first'.[3]

In the classic works of Pavlov and his associates, the formation of such 'rapid' sense associations (in the early work of Tsitovich, and later in the experiments of Narbutovich and others) was also demonstrated, although their special role in behaviour was not specially stressed.

An animal's reflection of its environment forms a unity with its activity, which means that, although there is a difference between them, they are at the same time inseparable

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[3] G. J. Romanes. *Mental Evolution in Animals.* With a Posthumous Essay on Instinct by Charles Darwin (Kegan Paul, Trench, London, 1885), p 180.

from one another. This means, furthermore, that there are reciprocal transfers between them, which consist in each reflection's being formed, on the one hand, in the course of the animal's activity; whether the object's property affecting the animal is reflected in its sensations, and how exactly, thus depends on whether the animal is really linked with the object in the course of its adaptation to its environment and how precisely it is linked with it. On the other hand, any activity of an animal's mediated by an influence sensed by it is performed in accordance with how the given influence is reflected in its sensations. The animal's activity, that links it *in practice* with objective reality, is understandably basic in this complex unity of reflection and activity; psychic reflection of the affective property of this reality is secondary and derivative.

The activity of animals in the earliest, first stage of the evolution of the psyche is characterised by its corresponding to some one separate affective property (or aggregate of separate properties) by virtue of the property's essential connection with the influences on which performance of their basic biological functions depends. The reflection of reality connected with this structure of activity correspondingly has the form of sensitivity to separate affective properties (or aggregates of properties), the form of elementary sensation. We shall call this stage in the evolution of the psyche the *elementary* sensory psyche. It covers a long series of animals, and it is possible that certain higher infusoria possess elementary sensitivity.

We can say that with much greater confidence in relation to such animals as certain worms, crustaceans, insects, and of course in relation to all vertebrates.

Variability of behaviour in consequence of established new connections has been demonstrated in worms by many researchers. Annelids, for example, as the experiments of Copeland and Brown have shown, either do not react at all to being touched by a glass rod, or react negatively. When, however, the touch of the rod is associated with feeding, then the worm's reaction alters: touching now evokes a positive reaction to food in it.[4]

Changes of this kind can acquire a more complicated

[4] See: M. Copelad and F. Brown. Modification of Behavior in *Neries virens. The Biological Bulletin*, 1934, *67*, 3.

character in crustaceans. When, for example, the abdominal part of a hermit crab is lightly stimulated mechanically when it is in a shell, that will evoke certain movements in it, as Ten Cate-Kazejewa's work has shown. [5] If, however, the stimulation is continued, the animal will quit the shell and run away. That fact is of little interest in itself; what is interesting is the crab's subsequent behaviour. If the experiment is systematically repeated, it turns out, the animal's behaviour becomes different. Now it removes its abdomen from the shell at the first touch, but never deserts it and almost immediately takes up its former position. The touch has now acquired a quite different meaning—it has become a signal for withdrawing the abdomen from the shell.

The material basis for the development of animals' activity and sensitivity is understandably their anatomical organisation. The common path of changes in organisms with which evolution at the stage of elementary sensory psyche is linked, consists on the one hand in animals' organs of sensitivity becoming more and more differentiated at that stage of evolution, and their numbers increasing; correspondingly their sensations are also differentiated. Cells irritable in relation to light in lower animals, are scattered over the whole surface of the body so that these animals can have only very diffuse light sensitivity.

Light-sensitive cells are gathered together at the anterior end of the body later, for the first time, in worms (Fig. 14, *A*), and, on becoming concentrated acquire the form of plates(*B*); these organs already provide a possibil-

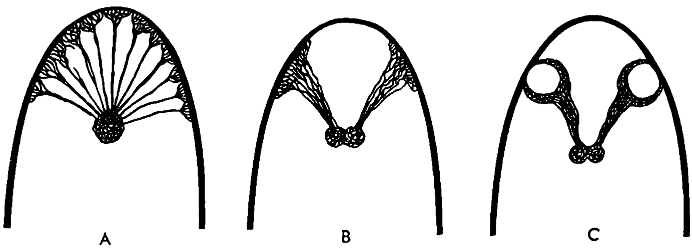

Fig. 14. Scheme of light-sensory structures of various types (after Buddenbrock)

[5] See: Ten Cate-Kazejewa. Quelques observations sur les Bernards l'hermites (*Paqurus arroser*), *Archives Néerlandaises de physiologie de l'homme et des animaux*, 1934, *19*, 4: 507-508.

ity of quite precise orientation in the direction of light. Finally, at an even higher stage of evolution (molluscs), an internal spherical light-sensitive cavity arises through bending of these plates, that operates like a camera lucida (*C*) that enables the movement of objects to be perceived.

On the other hand organs of locomotion are also evolved, organs of animals' external motion. Their evolution occurs specially noticeably in connection with the following two main alterations: on the one hand in connection with the transition to life in a terrestrial environment, and on the other hand, in hydrobionts (animals living in an aquatic environment) in connection with transition to active pursuit of prey.

Along with development of organs of sensitivity and organs of locomotion, an organ of connection and co-ordination of processes—a nervous system—also evolves.

Originally the nervous system is a simple network the fibres of which running in various directions unite sensitive cells located on the surface directly with the animal's contractile tissue. This type of nervous system is not found in contemporary species. In jelly-fish or medusae the nerve net leading from sensory cells is connected with muscular tissue already by means of motor nerve cells.

In such a reticular nervous system excitation is diffusely transmitted; the nerve fibres forming the network have two-directional conductivity, and inhibitory processes do not apparently exist. The next step in the evolution of the nerve system is represented in the differentiation of neurons that form central ganglia (nerve junctions). Along one line of evolution (among echinoderms) the nerve ganglia form an apipharangeal ring with nerve columns running off from it. This is already a nerve centre that enables relatively very complexly co-ordinated movements to be performed, such as a starfish's movements to open the shells of bivalves. Along two other major lines of evolution (from the primitive worms to crustaceans and spiders, and from primitive worms to insects) a more massive anterior (cerebral) ganglion becomes formed which subordinates the working of lower-lying ganglia to itself (see Figs. 15-17).

The origin of this type of nervous system is conditioned by differentiation of a leading organ along with other sense organs, which thus becomes the main organ mediating the organism's vital activity.

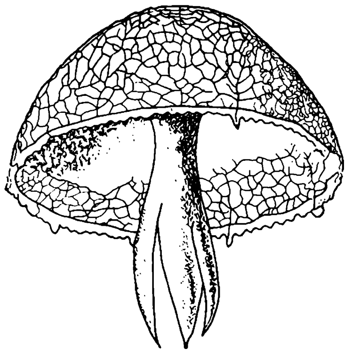

Fig. 15. Reticular nervous system of a medusa.

The evolution of such a ganglial nervous system took the direction of increasing differentiation, which was associated with segmentation of the animal's body.

The change of activity within this stage of evolution consisted in its ever greater complication, which occurred along with the evolution of animals' organs of perception and action and nervous system. Both the general type of structure of activity, however, and the general type of reflection of the environment did not alter greatly throughout this stage of evolution. Activity is stimulated and controlled by the reflection of a number of separate properties; the perception of reality is consequently never perception

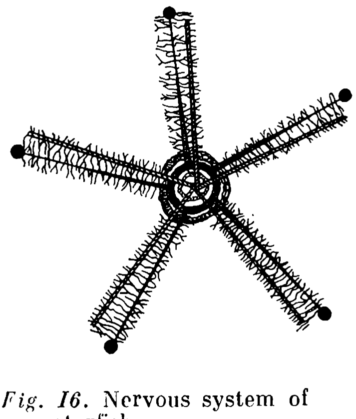

Fig. 16. Nervous system of a starfish.

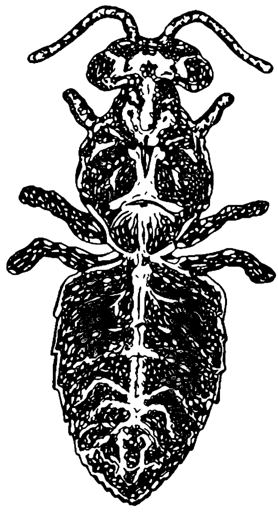

Fig. 17. Nervous system of an insect.

of the wholeness of things. In the least organised animals (e.g. worms) activity is always stimulated by the effect of one property of some sort, so that, for example, a characteristic feature of their search for food is that it is always made (as Wagner says) 'by means of some one sense organ, without the assistance of other sense organs: touch, more rarely smell or vision, *but always only one of them*'.[6]

The complicating of activity within the limits of this common type takes two main directions, one of which is most clearly expressed in the line of evolution leading from worms to insects and spiders. It is manifested in the activity of animals acquiring the character of sometimes very long chains consisting of a great number of reactions corresponding to separate consecutive influence. A vivid example is the often cited behaviour of the larva known as the ant lion.

The ant lion buries itself in sand just so deep that grains of sand begin to touch the surface of its head, which causes a jerking backthrusting of the head and anterior part of the body that throws the sand upward. As a result a funnel of regular shape is formed in the sand at the centre of which the ant lion's head juts out. When an ant gets into the funnel it

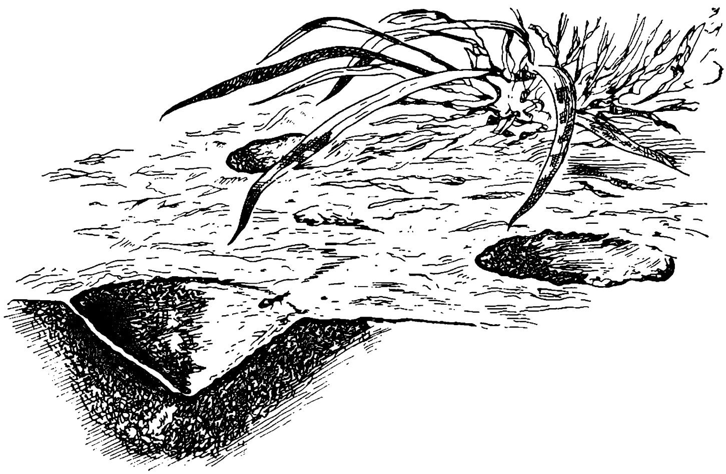

Fig. 18. Funnel-shaped sandholes of the ant lion (after Doflein).

[6] V. A. Wagner. *Vozniknovenie i razvitie psikhicheskikh sposobnostei*, No. 8, 1928, p 4.

inevitably causes a few grains of sand to slide down. These, falling on the ant lion's head, trigger off the 'throwing' reflex described. Some of the sand thrown up hits the ant, which slides down to the bottom of the funnel with the falling sand. Then, as soon as the ant touches the jaws of the ant lion, they shut on it and the victim is sucked dry (See Fig. 18, after Doflein, simplified).

The mechanism of this activity is one of elementary reflexes—innate unconditioned and conditioned.

Activity of this kind is particularly characteristic of insects in which it attains its highest degree of development. This line of the complicating of activity is not progressive and does not lead to its subsequent qualitative alteration.

The other line followed by the complicating of activity and sensitivity, on the contrary, is progressive. It leads to a change in the structure of the activity itself and on that basis to the rise of a new form of reflection of the environment characterised by an already higher, second stage in the evolution of animals' psyche, namely that of the perceptive psyche. This progressive trend is linked with the progressive line of biological evolution (from wormlike animals to primitive chordates and then to vertebrates).

The complicating of animals' activity and sensitivity is expressed here in their behaviour being governed by a combination of many simultaneous influences. Examples can be drawn from the behaviour of fish. A marked contradiction is distinctly observable in them between an already relatively very complex content of processes of activity and a high development of separate functions on the one hand, and a still primitive structure of this activity on the other hand.

Let us turn again to special experiments.

In an isolated aquarium in which live two young American catfish, a white cheesecloth partition is fixed that does not stretch as far as one of the walls, so that there is a free space between it and the wall.

When the fish, which usually keep together, are in a certain end of the aquarium (always the same one), a bit of meat is dropped to the bottom of the other end. Attracted by the spreading flavour of meat the fish make directly for it along the very bottom. In doing so they come up against the gauze partition; having approached to within a few mil-

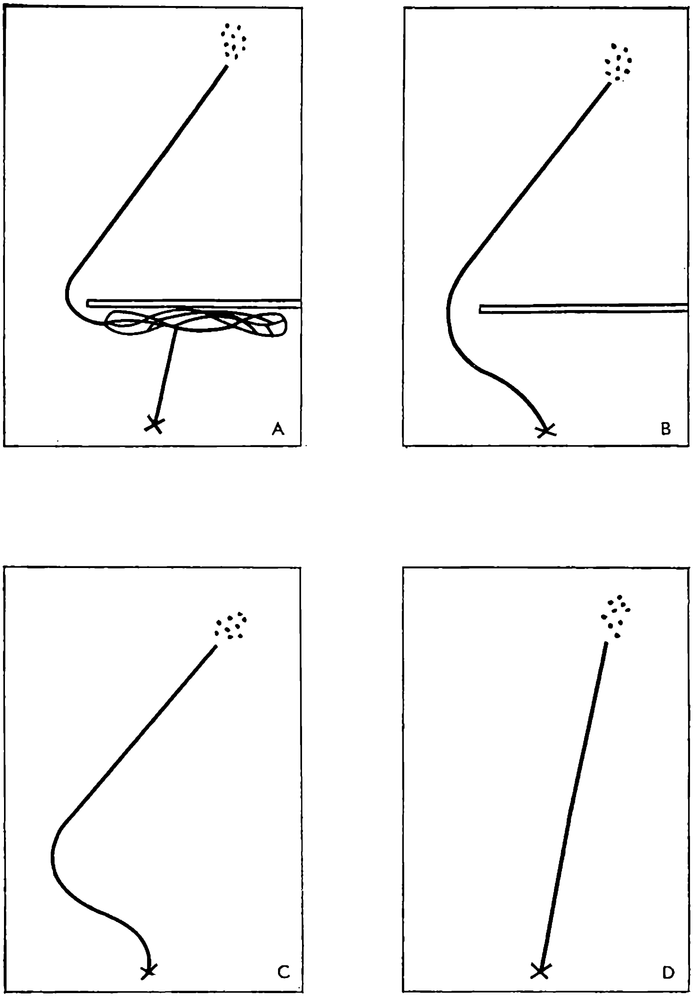

Fig. 19. Scheme of experiments with fish (after Zaporozhets and Dimanstein).

limetres of it, they remain for a moment seeming to regard it, and then swim along it from one side to the other, until by chance they find themselves opposite the gap at the side, through which they can penetrate into the part of the aquarium where the meat is.

The fish's observed behaviour is due to two main influences. It is excited by the scent of meat and develops in the direction of this main, dominant influence. On the other hand the fish perceive (visually) a barrier, so that their movement toward the spreading scent takes on a complicated, zigzag character (see Fig. 19, *A*). This is not, however, a simple chain of movements: at first there is a reaction to the stretched gauze and then a reaction to the scent. There is also no simple merging of these two influences giving rise to a resultant movement. It is complexly co-ordinated activity in which a two-fold content can be objectively distinguished: (1) a definite direction of activity leading to an appropriate result (this content arises under the influence of the scent, which has the biological sense of food for the animal); (2) turning movements proper (the content of which is associated with a definite influence—the barrier—but this influence is distinguished from the effect of the smell of food, and cannot independently excite the animal's activity; the gauze in itself does not cause any reaction in the fish). This second effect is not associated with an object that excites activity and toward which it is directed, but with the conditions in which this object is presented. This is an objective difference between the two effects and is their objective relationship. Is the objective relationship, however, reflected in the activity of the fish being studied? Does it also operate differently for the fish? Does the one operate as associated with the object, i. e. with what stimulates activity? And the second as relating to the conditions of the activity, in general as an *other*?

To answer that let us continue with the experiment.

As the experiments in feeding the fish in the presence of a barrier on their path to the food continued, there is a kind of gradual 'melting away' of surplus movements so that finally the fish immediately move toward the gap between the gauze and the wall of the tank, and then to the food (Fig. 19, *B*).

Let us now pass to the second part of the experiment. In it we remove the barrier before feeding the fish. Although

it was located quite close to the initial point of the fish's movement, so that they could not help noticing its absence in spite of their relatively weak vision, nevertheless the fish fully followed the roundabout path, i. e. moved as they would if the barrier had been in place (Fig. 19, *C*). Subsequently their path straightened, of course, as is shown by Fig. 19, *E*, but that happened only gradually.

Thus the effect governing the roundabout movement was firmly associated in the studied fish with the effect of the food itself, with its smell. That means that it was perceived by the fish right from the start continuously with the smell of food, and not as a component of another 'node' of interconnected properties, i. e. the property of another *thing*.

Thus, as the result of a gradual complicating of animals' activity and sensitivity, we observe the rise of a developed non-conformity, a contradiction in their behaviour. In the activity of fish (and seemingly of certain other vertebrates) a content is already observed such as objectively corresponds to the influencing conditions; for the animal itself this content is associated with the influences in relation to which its activity as a whole is directed. In other words animals' activity is governed in fact by an influence already coming from separate *things* (food, a barrier), while the reflection of reality remains a reflection in them of the aggregate of its different *properties*.

During subsequent evolution this non-conformity was resolved through a change in the leading form of reflection and a further restructuring of the animals' general type of activity; there was a transition to a new, higher stage of development of reflection.

Before we start to examine this new stage, however, we must first dwell on yet another special problem that arises in connection with the general issue of the variability of animals' activity and sensitivity.

This is the matter of so-called instincts, i. e. of innate, unconditioned reflex behaviour and of behaviour that is altered by the effect of an animal's external conditions of existence, and by its individual experience.

Views that link the successive stages in the evolution of the psyche with these different mechanisms of animals' adaptation to their environment are very common in psychology. The lowest stage in the evolution of the psyche is pictured, from this point of view, for instance, as beha-

viour based on animals' so-called tropisms or instincts; higher stages of evolution are formed by individually alterable behaviour, i. e. behaviour built on conditioned reflexes.

These views are based on the indisputable fact that the higher we go up the ladder of biological evolution, the more and more perfected is animals' adaptation to variability of the environment, the more dynamic their activity becomes, and the easier it is for animals to 'learn'. The concrete understanding of the development of animals' behaviour, however, advanced by the holders of this point of view, is extremely simplified and is, in essence, incorrect.

First of all, there is no foundation for counterposing, as different genetic stages of behaviour, (a) inherited behaviour, allegedly unalterable by external influences, and (b) behaviour built up in the course of an animal's individual development, in the course of its individual adaptation. 'Individual adaptation', Pavlov said, 'exists throughout the animal world.'[7]

The counterposing of innate and individually adapted behaviour came about, on the one hand, from incorrect reduction of the mechanisms of animals' behaviour to its innate mechanisms, and on the other hand from the old, idealist understanding of the term 'instinct'.

Tropism is usually considered the simplest form of innate behaviour. The theory of tropisms in relation to animals was developed by Loeb. According to him a tropism is a forced, automatic movement caused by a dissimilarity of physico-chemical processes in the symmetrical parts of an organism as a consequence of the one-sidedness of influences affecting it.[8]

An example of this forced and invariable movement is the growth of the roots of a plant, which is always downward no matter in what position we place the plant. Similar phenomena can also be observed in animals; it does not follow from that, however, that the activity of these animals boils down to a mechanism of tropisms and that it is not plastic, altering through the effect of experience.

We know, for example, that most *Daphnia* possess posi-

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[7] I. P. Pavlov. *Polnoe sobranie trudov*, Vol. 3 (Izd-vo AN SSSR, Moscow-Leningrad, 1949), p 415.

[8] See: Jacques Loeb. *Forced Movements, Tropisms, and Animal Conduct* (Lippincott Co., Philadelphia, 1918).

tive phototropism, i. e. that they perform forced movements toward light. The behaviour of *Daphnia*, however, as the special experiments of Blees[9] and of Soviet workers (Leontyev and Basin) have shown, in no way resembles the 'behaviour' of plant roots.

Blees's experiments were made as follows.

A small, flat aquarium, illuminated from one side only, was used. A glass tube, bent at a rigth angle, was fixed in the centre of the tank so that one end lay horizontal under the water and the other end projected vertically out of the water (Fig. 20).

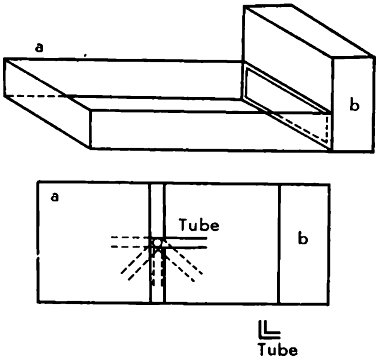

Fig. 20. Set-up for experiments with water fleas (*Daphnia*) (after Blees).

At the start of the experiments the horizontal limb pointed toward the illuminated wall of the tank, i. e. toward the light source (positioned as shown in Fig. 20).

Water fleas (*Daphnia*) were pipetted and put into the tube; they quickly passed down the vertical part to the bend and began at once to move along the horizontal limb toward the light. On emerging from the tube they then swam freely to the illuminated wall of the tank. Their behaviour thus remained strictly controlled by the effect of light.

In the next experiments the tube was rotated by 45° from the direction of the light (as shown by the dotted lines in Fig. 20).

In these conditions the water fleas came out of the tube as before but more slowly.

That fact is also easily explainable from the angle of tropism. It can be supposed that we have a summation of two directions here, the influence of the light and the influ-

[9] See: G.H.T. Blees. Phototropisme et expériences chez la daphnie. *Archives Néerlandaise de physiologie de l'homme et des animaux*, 3, 1919, 3.

ence of the wall of the tube, obstructing direct movement, and now pointing a bit to one side. The summation of these two directions is also expressed in the fleas' slow passage through the tube. Repetition of these experiments, however, demonstrated that the fleas' passage through the tube was quicker and quicker, until finally it was close to the speed needed to negotiate the tube when it pointed directly to the light. A certain training was consequently observed in *Daphnia*, i. e. their behaviour was gradually adapted to the given conditions.

In the next experiments the tube was turned to 90°, then to 135°, und finally to 180°. In all these positions the water fleas also gradually learned to pass quite quickly out

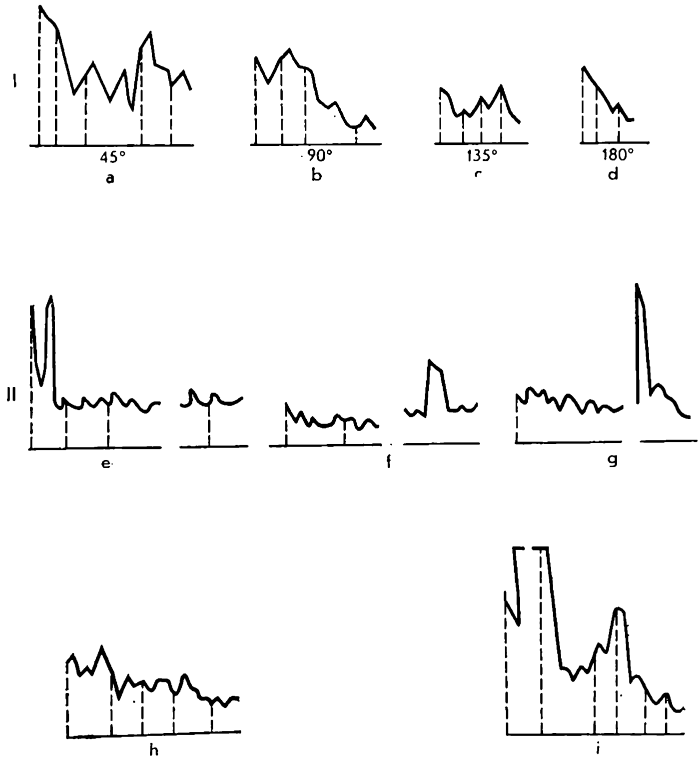

Fig. 21. Variability of the behaviour of *Daphnia*: I — Blees's experiment (Blees, 1919); II — experiments of Leontyev, Basin, and Solomakha, 1933-1943).

of it, although they were forced in the last two cases to move away from the light in a direction opposite to their tropism (Fig. 21).

That fact can also be shown at first glance not to contradict the 'forced character' of phototropism in *Daphnia*; it can be supposed that their positive tropism is converted into negative tropism by an influence unknown to us. That supposition, however, is refuted by the fact that after emerging from the tube the fleas again moved toward the light.

Thus, as follows from the facts adduced, the behaviour of water fleas by no means consists in machine-like, forced movements or tropisms. The tropisms of animals are not elements of a wholly mechanical behaviour, but mechanisms of elementary behaviour processes, behaviour that is always plastic and capable of being reorganised in accordance with the environment's changing conditions.

Another concept with which the notion of animals' innate, rigorously fixed behaviour is linked in psychology is that of instinct. There are various views about what constitutes an instinct. The most common is the idea of instinctive behaviour as behaviour that is inherited and does not require learning of any kind, behaviour that is performed through the effect of certain stimuli and always in a certain way, and that is completely identical in all members of a given species. It is therefore 'blind' and does not take into account the features of the individual animal's external conditions, and is capable of being altered only in the long run of biological evolution. That is the view of instinct held, for example, by the famous naturalist Fabre.[10]

In fact, we can quite definitely distinguish, in most highly developed animals, between processes, on the one hand, such as are manifestations of consolidated behaviour built up during the species' history and inherited (e. g. the innate 'ability' of certain insects to build honeycomb), and on the other hand, such as arise during animals' 'learning' (e. g. bees' learning to choose correctly a feeding dish of syrup marked by a figure of a certain shape).

As the findings of numerous investigations have shown, however, it is impossible to counterpose species behaviour and individually developed behaviour at even the lowest

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[10] See: J. H. Fabre. *Souvenirs entomologiques* (Delagrave, Paris, 1910).

stages of the evolution of animals. Animals' behaviour is, of course, also species behaviour, but it is at the same time very plastic.

Rigorously fixed instinctive behaviour is thus by no means the initial stage in the development of animals' behaviour. That is the first point.

The second point is that there is also no instinctive behaviour in animals' activity at higher stages of evolution such as is unalterable by the effect of an animal's individual living conditions. That means, strictly speaking, that there is no behaviour in general that is fixed once and for all, and that follows *only* a ready-made pattern laid down in advance in the animal itself. The notion of such behaviour in animals is the result of insufficiently thorough analysis of the facts. An example is one of the experiments performed by Fabre, which was later refined.

In order to demonstrate that instinctive behaviour corresponds only to strictly defined conditions of the life of a species and is incapable of being adapted to new unusual conditions, Fabre mounted the following experiment with solitary bees. These bees, when first emerging from the nest, gnaw through the solid mass that encases them.

Fabre covered one group of nests with paper so that it lay directly on the nest itself, while he covered another group with a cone made of exactly the same paper placed so that its walls were a little way from the nest. The bees that emerged from the nests of the first group, it proved, gnawed through the wall of the nest covering them and also through the paper and emerged into freedom. The bees emerging from the nests of the second group also gnawed through the wall of the nest, but could not gnaw through the wall of the paper cone separated by a certain space from the nest, and so proved doomed to die. He concluded from the experiment that the insect could only continue the instinctive act of gnawing to get out of the nest for a little while but are unable to recommence it on encountering a second barrier, however insignificant the latter, i. e. that instinctive behaviour can only be performed according to a previously developed stereotyped sequence, completely blindly.

Fabre's experiment, however, was unconvincing. He did not analyse the bees' behaviour sufficiently in the situations created by him. It subsequently was discovered that in the second case the bees were in a trap not because they

could not adapt their behaviour to the second existence of a barrier unusual in normal circumstances (the second paper wall around the nest), but simply because by virtue of the structure of their jaws they could not get a grip on the smooth surface of the paper, although they tried to do so. Other experiments demonstrated that if a glass tube was placed opposite the exit from the nest and closed with clay at the other end, the insect, after gnawing through the wall of the nest, continued along the tube and on encountering the second barrier, the clay cork, gnawed through it. The act of gnawing in bees can consequently be recommenced in case of necessity, which means that their instinctive behaviour is not wholly subordinated to a previously established sequence of its constituent acts.

Detailed study of species innate behaviour (in solitary wasps, spiders, drayfish, fish, and other animals) thus indicates that it in no way consists of unalterable chains of movements fixed by heredity, the individual links of which automatically follow one after the other, but that each of these links is evoked by certain sensory signals, so that the behaviour as a whole is always governed by the given actual conditions and can be altered considerably.[11]

Even more obvious is the fact that animals' so-called individual behaviour is shaped in turn on the basis of species instinctive behaviour and cannot otherwise arise. This means that just as there is no behaviour completely performed by innate movements that are unalterable by the influence of externally operative effects, so there are also no habits or conditioned reflexes that do not depend on innate moments. Both types of behaviour should therefore not be counterposed to one another in any way. We can only affirm that innate mechanisms play a greater role in some animals and mechanisms of individual experience in others. This difference, however, also does not reflect the real stadial character of the evolution of the psyche in the animal world. Rather it indicates a peculiarity characteristic of different lines of animal evolution. Innate behaviour is most clearly manifested, for instance, in insects, which are known to be located on a side branch of evolution.

A difference in the type of mechanisms that implement animals' adaptation to changes in the environment thus

[11] See: E. Rabaud. *Art. cit.*

cannot serve as the sole criterion of the evolution of their psyche. It is not only in what main way animals' behaviour is altered that is important but primarily what its content itself and inner structure are and what are the forms of reflecting reality that are naturally associated with them.

2. The Stage of the Perceptive Psyche

The next stage after that of the elementary sensory psyche, the second stage of evolution, can be called that of the perceptive psyche. It has the capacity to reflect external, objective reality already in the form of a reflection of *things* rather than in the form of separate elementary sensations evoked by separate properties or a combination of properties.

The transition to this stage in the evolution of the psyche is associated with a change in the structure of animals' activity already prepared for in the preceding stage. This change consists in the content of this activity already mentioned above, which is objectively related to the conditions in which the object is objectively given in the environment, rather than to the object itself toward which the animal's activity is directed, now being distinguished. This content is no longer associated with what excites the activity as a whole but responds to the special influences that evoke it.

When a mammal is separated from food by an obstacle, it will, of course, go around it. That means that, as in the behaviour of the fish described above in conditions of an obstructed tank, we can distinguish a certain content in its activity relating objectively to the barrier, which represents one of the external conditions in which the given activity takes place, rather than to the food itself toward which it is directed. Between the activity of fish described and that of mammals, however, there is a great difference, which is expressed in this, that while the content of the fish's activity (roundabout movements) was retained after removal of the barrier and disappeared only gradually, higher animals usually make directly for the food in such a case. This means that the influence to which mammals' activity is directed no longer merges with influences from the barrier in them, but both operate separately from one another for them. The direction and end result of the activity depends

on the former, while the way it is done, i. e. the mode in which it is performed (e.g. by going around the obstacle) depends on the latter. This special make-up or aspect of activity, which corresponds to the conditions in which the object exciting it is presented, we shall call *operation.*

It is this distinguishing of operations in activity that indicates that properties affecting an animal, which previously seemed to be all of a muchness to it, begin to fall into groups: on the one hand interconnected properties emerge that characterise the object to which the activity is directed, while on the other hand properties emerge of objects that determine the mode of the activity itself, i. e. the operation. Whereas differentiation of the affecting properties was linked at the stage of the elementary sensory psyche with their simple uniting around the dominant stimulus, the integrating of the affective properties into a single integral image, and their unification as the properties of one and the same thing now arise for the first time. The surrounding reality is now reflected by the animal in the form of more or less separated images of separate things.

The majority of now existing vertebrates are at various levels of the stage of the perceptive psyche. The transition to this stage was seemingly linked with the passage of vertebrates to a terrestrial mode of life.

The rise and development of a perceptive psyche in animals were governed by several essential anatomical and physiological changes. The main one was the development and change of role of distant sense organs (i.e. ones operating at a distance), primarily of vision. Their development was expressed in an alteration both of their significance in the general system of activity and in the form of their anatomical interconnections with the central nervous apparatus. Whereas differentiation of sense organs in the preceding stage of evolution had led to the singling out of dominant organs among them, among vertebrates the leading organs more and more became those that integrate external influences. That became possible because of the simultaneously occurring restructuring of the central nervous system and the formation of a forebrain, and then of a cerebral cortex (for the first time in reptiles). Originally (among fish, amphibians, and reptiles) the forebrain was a purely olfactory formation constituting a sort of continuation of their central olfactory apparatus. In subsequent evolution (among

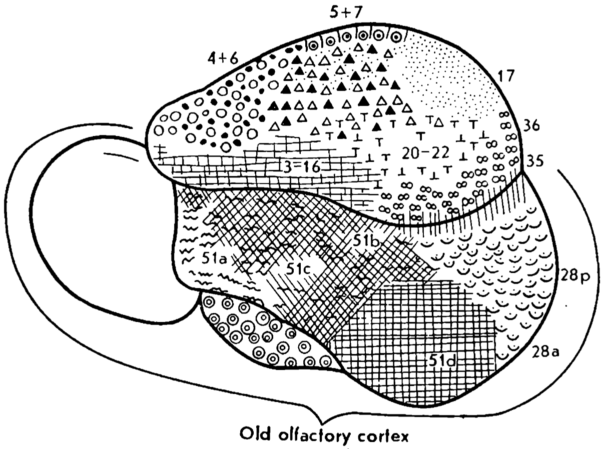

Fig. 22. Olfactory region of the cerebral cortex of hedgehog.

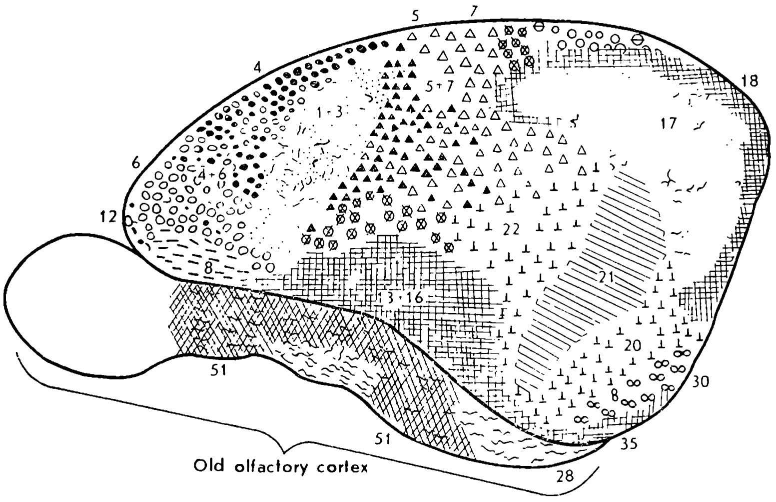

Fig. 23. Olfactory region of the cerebral cortex of a lower ape.

mammals) the importance of the olfactory centres in the cerebral cortex was greatly reduced through the representation of other sence organs. This is clearly seen when we compare the place occupied by the olfactory cortex, for example, in a hedgehog (Fig. 22) and a monkey (Fig. 23).

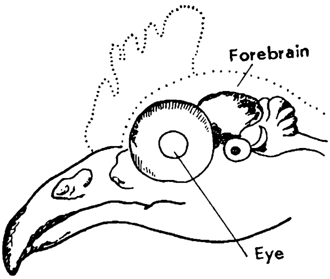

Fig. 24. The brain of a bird.

Vision, on the contrary, whose 'corticalisation' occurred initially with the reptiles, occupies a relatively ever greater place in the cortex (see Fig. 24). In birds the eyes become the main receptor (Fig. 25). Vision also plays the main role in many higher mammals.

The organs of external movement developed simultaneously, i.e. animals' 'natural tools' enabling them to perform the complicated operations demanded by life in a terrestrial environment (running, climbing, pursuing prey, overcoming obstacles, etc.). Animals' motor functions were also

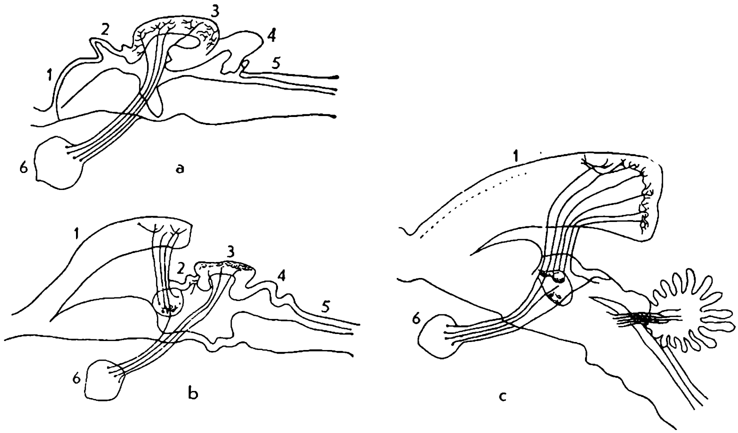

Fig. 25. Gradual shifting of the visual centres in the cerebral cortex of vertebrates (after Monakov). Visual paths and centres of the brain — (a) of a frog, (b) of a reptile, (c) of a mammal; 1—the forebrain; 2—the between-brain (diencephalon); 3—the midbrain; 4 — the cerebellum; 5—the medulla oblongata; 6—an eye.

more and more corticalised (i.e. transferred to the cortex of the brain), so that full development of operations proceeded in animals in connection with the evolution of the cortex.

Thus, whereas the activity of lower vertebrates was still mainly linked with lower-lying centres (subcortical ganglia), it subsequently became more and more dependent on the cortex, changes in whose structure also reflect all its subsequent evolution.

Differentiation of the operations that characterise the stage of the perceptive psyche laid the basis for the evolution of a new form of fixing animals' experience, for fixing it in the form of motor habits in the narrow sense of the term.

Any connections arising in individual experience are sometimes called habit. In that wide conception, however, the concept of habit becomes very blurred, embracing a vast circle of quite different processes, beginning with changes in the reactions of infusoria and ending with man's complicated actions. In contrast to that, in no way justified broadening of the concept of habit, we shall call only fixed operations habits.

That definition of habit coincides with the understanding of habits first advanced in Soviet psychology by Protopopov, who demonstrated experimentally that motor habits are formed in animals from the motor elements of overcoming obstacles, and that the content of habits is determined by the character of the obstacle itself, while the stimulus (i e. main exciting influence) only affects a habit dynamically (the speed and firmness of its forming) and is not reflected in its content.[12]

The motor elements forming part of the habits of animals may be different in character; they may be both species, innate movements and movements acquired in previous experience; finally they may be movements fixed in the course of the chance motor trial and error made by the animal during the formation of the given habit.

Clearly expressed habits in the proper sense are observed at first only in animals that have a cerebral cortex. The mechanism of the formation and fixing of systems of precisely cortical conditioned nerve connections must there-

[12] See: V. P. Protopopov. *Usloviya obrazovaniya motornykh navykov i ikh fiziologicheskaya kharakteristika* (The Conditions for the Forming of Motor Habits and Their Physiological Characteristics), Kharkov-Kiev, 1935.

fore be considered the physiological base of the formation of habits.

During the transition to the stage of perceptive psyche the sensory form of the fixing of experience also changes qualitatively. Sense representations arise for the first time in animals.

The problem of the existence of representations in animals is still a matter of dispute. A vast number of facts, however, convincingly indicate that animals have representations.

Tinklepaugh's experiments underlay systematic experimental study of this problem. He showed fruit to an animal (monkey) and then, behind a board, surreptitiously replaced it by lettuce, which is much less attractive. The animal was then allowed to move behind the partition; though finding lettuce there it nevertheless continued to look for the fruit previously seen.[13]

Similar experiments made with a fox by Voitonis and Kreknina yielded the same results.[14]

The observations on a dog described by Beritov are of great interest in this respect.[15] In his experiments with conditioned reflexes, the dog was put in a certain spot and then given a conditioned signal in response to which it ran to a simultaneously uncovered feeding dish, and received food. During these experiments the following test was made: before the dog was brought into the laboratory, it was walked to the far end of the corridor and shown food lying there, without however being signalled to take it. Then it was led back to the laboratory and given the conditioned signal. When it ran to the feeding dish, however, there was no food there. It proved, in these conditions, that the dog did not return as usual to its place but ran out into the corridor to the spot where it had previously seen food.

Buytendijk and Fischel's experiments with dogs were of a more specialised character. They were able to demonst-

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[13] See: O. L. Tinklepaugh. An Experimental Study of Representative Factors in Monkeys. *The Journal of Comparative Psychology*, 1928, *8*, 3: 197-236.

[14] See: H. Yu. Voitonis, A. V. Kreknina. Data on the Comparative Psychological Study of Memory. In: *Instinkty i navyki* (Moscow, 1935).

[15] See: I. S. Beritov. Reflex and Behaviour. In: *Trudy biologicheskogo sektora AN SSSR, Gruzinskoe otdelenie*, Vol. 1, 1934.

rate experimentally that in contrast to lower vertebrate organisms (fish), a dog is oriented in reactions to a previously experienced situation (a lure concealed from its sight) on the actual thing that it has been shown.

Thus, together with a change in the structure of animals' activity and a corresponding change in the form of their reflection of reality there is also a restructuring of the function of memory. Earlier, at the stage of elementary sensory psyche, this function was expressed in the motor sphere of animals in the form of a change, under the impact of external influences, in movements associated with the influence affecting the animal, and in the sensory sphere in a reinforcement of the links between separate effects. Now, at this higher stage of evolution, the mnemonic function operates in the motor sphere in the form of motor habits, and in the sensory sphere in the form of a primitive, image memory.

The processes of analysing and generalising the environment affecting animals undergo even greater changes in the transition to the perceptive psyche.

Already in the first stages of the evolution of the psyche processes of animals' differentiation and uniting of separate effects can be observed. When, for example, an animal that earlier reacted identically to two different sounds, is put into a situation in which only one of these sounds will be associated with a biologically important effect, the other will gradually cease to evoke any reaction whatever in it. The sounds are differentiated from one another; the animal now reacts selectively. Conversely, when a whole number of different sounds are associated with one and the same biologically important effect, the animal will react identically to any one of them; they take on an identical biological meaning for it. There is a primitive generalising of them. Thus, within the stage of the elementary sensory psyche processes both of differentiation and of generalisation of separate influences and separate affective properties by the animal are observed. In that respect it is important to note that these processes are not governed by an abstractly selected correlation of effects but depend on their role in the animal's activity. Therefore, whether animals easily differentiate between various influences or not and generalise them or not depends not so much on their degree of objective similarity as on their concrete biological role. Bees, for instance, easily differentiate between forms similar to the

forms of a flower, but have difficulty in differentiating between even clearly different abstract forms (triangles, squares, etc.).

That position holds as well in subsequent stages of the evolution of the animal kingdom. Dogs, for example, react to even slight scents of animal origin, but do not react to plant smells and perfumes, etc. (Binet and Passy[16]). In general, when a given odour acquires biological sense for a dog, it is capable of differentiating it very finely; the findings of special research indicate that a dog distinguishes in experimental conditions between odours of very dilute organic acids (one part in a million).[17]

The main change in the processes of differentiation and generalisation during the transition to a perceptive psyche is expressed in the rise in animals of differentiation and generalisation of the images of things.

The origin and evolution of a generalised reflection of things is already a much more complex problem, on which we must dwell specially.

The image of a thing is not a simple sum of individual sensations or the mechanical product of many simultaneously operating properties belonging to objectively different things. If, for instance, we have two things of whatever sort A and B that possess properties a, b, c, d and m, n, o, p, then, for an image to arise, these separate affective properties must function as part of two separate entities (A and B), i. e. they must be differentiated in precisely that respect. This means, also, that when the given influences are repeated among others, their previously differentiated unity must be perceptible as the thing itself. Given the inevitable variability of the environment, however, and of the conditions of perception itself this is only possible when the image of the thing arising is generalised.

In the cases described we see dual interconnected processes: those of the transfer of operations from one concrete situation to another, objectively similar to it, and those of the forming of a generalised image of a thing. The generalised image of the thing, in arising together with the shaping of an operation in relation to, and on the ba-

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[16] Cited from H. Henning. Geruchsversuche am Hund. *Zeitschrift für Biologie*, 1921, *70* (neue Folge 52) :1.

[17] H. Henning. *Op. cit.*

sis of, this thing, enables the operation to be transferred subsequently to a new situation; in this process the previous operation comes into a certain disharmony with the object conditions of activity through the changes in these conditions and therefore of necessity is altered and reorganised. The generalised image of the thing is correspondingly reorganised, made more precise, and absorbs the new content as it were, which in turn leads to the possibility of a further transfer of the operation to new object conditions calling for their ever fuller and more correctly generalised reflection by the animal.

Perception is thus still fully included here in the animal's external motor operations. Generalisation and differentiation, synthesis and analysis take place in a single process.

The evolution of operations and generalised perception of the surrounding external reality finds its reflection in a further complicating of the cerebral cortex. There is further differentiation of the integrative fields, which occupy an ever bigger place in the cortex (see Fig. 26).

The function of these higher integrative fields is, as their name implies, precisely to integrate separate influences.

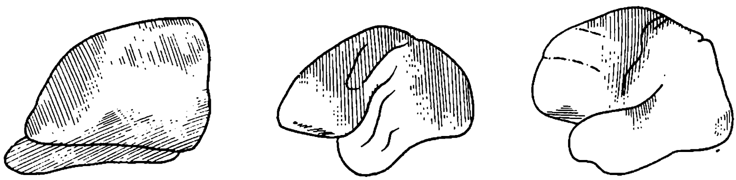

Fig. 26. The cerebral cortex of a rabbit, lower ape, and man. Hatched zones—projection fields; unhatched zones—integrative field. There is a marked relative increase in the unhatched areas (integrative fields) as we pass to higher stages of development (after von Economo). (Note: the drawings are not to scale.)

3. The Stage of Intellect

The psyche of most mammals remains at the stage of the perceptive psyche, but the most highly organised mammals have risen to an even higher stage of evolution.

This new, higher stage is normally called the stage of intellect (or 'manual thinking').

The intellect of animals, of course, is not quite the same as human reason; as we shall see, there is an immense qualitative difference between them.

The stage of intellect is characterised by very complex activity and just as complex forms of reflecting reality. Therefore, before we deal with the conditions for the passage to this stage, we must describe the activity of animals that are at this stage of evolution in its external expression.

The intellectual behaviour of the most highly developed animals—the anthropoid apes—was first systematically studied in the experiments carried out by Köhler.

These experiments followed this pattern.

The apes (chimpanzees) were housed in a cage. Outside the cage, just far enough away that the ape's arm could not reach it, bait was placed (bananas, oranges, etc.). Inside the cage there was a stick. The ape, attracted by the bait, could only bring it closer to itself in one way, by using the stick. How did the ape behave in this situation? As it happened, it first began to try and snatch the bait directly with its hand. The attempts were unsuccessful. The ape's activity seemed to fade for a time. It turned away from the bait and stopped its attempts. Then activity was resumed, but now took another path. Without trying to grab the fruit directly by its hand, the ape picked up the stick, thrust it toward the fruit, touched it, drew the stick back, again thrust it out and again drew it back, with the result that the fruit was drawn closer and the ape snatched it up. The problem was solved.

The many other problems set anthropoid apes have been built on the same principle; their solution also required the adoption of a mode of activity such as could not be formed during solution of the problem set. For example, bananas were hung from the upper lattice of the enclosure where the apes were kept, out of their direct reach. Nearby was an empty box. The only possible way of reaching the bananas in this case was to drag the box over to the spot above which the bananas hung, and to use it as a stand. Observations showed that apes solved this problem without noticeable preliminary learning.

Thus, while operations are formed slowly at a lower stage of evolution, by way of many trials during which suc-

cessful movements are gradually fixed, and other, unnecessary movements are gradually inhibited, and fade out, in the case of apes we observe first a period of complete failure—many attempts not leading to accomplishment of the activity, and then suddenly, as it were, the finding of an operation that almost immediately leads to success. That is the first characteristic feature of the intellectual activity of animals.

A second characteristic feature is that when an experiment is repeated once more, the operation concerned is reproduced, in spite of its having been performed only once, i.e. the ape solves a similar problem already without any preliminary trials.

A third feature of this activity is that the solution found for a problem is very easily transferred by the ape to other conditions only similar to those in which the given solution was first found. If an ape, for example, has solved the problem of bringing fruit closer to it by means of a stick, it proves that, if it is now deprived of the stick, it easily employs some other suitable object in place of it. If the position of the fruit is altered in relation to the cage, or if the situation is altered slightly in general, the animal all the same finds the necessary solution. The solution, i.e. the operation, is transferred to another situation and adapted to this new situation, rather different to the first one.

We must note one group of facts among the many obtained in experimental research with anthropoid apes, which has a certain qualitative peculiarity. These facts show that anthropoid apes are capable of uniting two different operations into a single activity.

For example, bait is placed outside the cage in which the animal is housed, at a certain distance from it. Rather nearer to the cage but also beyond the animal's reach is a long stick. Another shorter stick that can reach the long one but not the bait is put into the cage. To solve this problem the ape must first pick up the short stick, draw the long stick to itself, and then pull the bait to it with the long stick (see Fig. 27). Apes usually cope with such 'two-phase' tasks without special difficulty. So a fourth feature of intellectual activity consists in a capacity to solve two-phase tasks.

Subsequent experiments by other researchers have shown that these characteristic features are preserved as well in

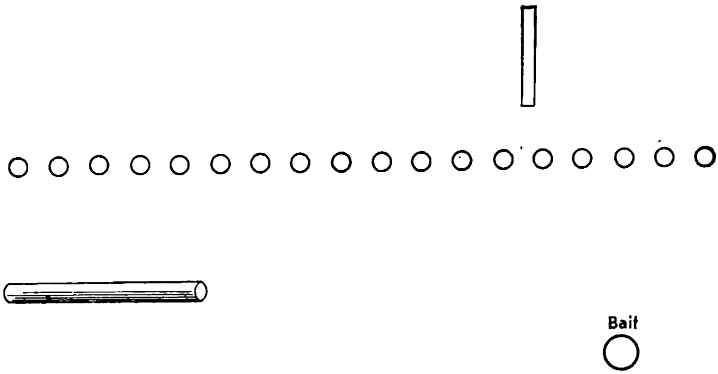

Fig. 27. Scheme of a two-phase problem.

the more complicated behaviour of anthropoid apes (Ladygina-Kots and Vatsuro).[18]

An example of the solution of a very complicated task by an anthropoid ape is the following experiment (Fig. 28). In the enclosure where the apes lived a box was set one side of which was a cage while the other side had a narrow, longitudinal slit. Fruit was put near the back of this box, clearly visible both through the bars at the front, and through the slit behind. The bait was too far away from the bars for the ape to reach it. It was also impossible to reach the bait from the rear wall itself because the slit was too narrow to admit the ape's arm. A strong stake was driven into the ground near the rear wall, and a stick fastened to it by a not very long chain.

The solution of this problem consisted in pushing the stick through the slit in the rear wall and shoving the fruit forward to the front bars, through which it could then be pulled out simply by the hand.

How did the ape behave in this situation? On coming up to the cage and noticing the fruit, it first tried to reach it through the bars. Then it went round the box and looked at the fruit through the slit at the back. It tried to pull the fruit through the slit by means of the stick, but that

[18] See: N.N. Ladygina-Kots. *Issledovanie poznavatel'nykh sposobnostei shimpanze* (Research into the Cognitive Faculties of Chimpanzees), Moscow, 1928.

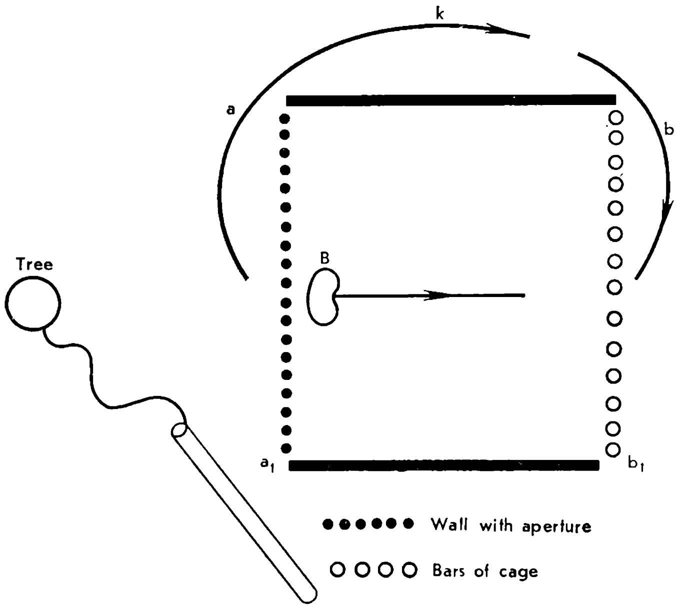

Fig. 28. Scheme of a complex problem.

was impossible. Finally, the animal pushed the fruit away with the stick, and went round the box so as to pull it out through the bars.

How were all these complicated operations, observed in the experiments described, formed? Did they really originate suddenly without any preliminary preparation, as it seemed from the first outward impression? Or were they built up in the main in the same way as in the preceding stage of evolution, i.e. through gradual, albeit much faster, selection and fixing of movements leading to success?

The answer to that is clear from an experiment described by French workers, which was carried out as follows. An anthropoid ape was housed in a cage. A small box was fixed on the outside of the bars with an opening on the side opposite the bars. An orange was put close to the wall of the box. To get it in this situation the animal had to knock it out of the box by a blow. Since such a blow could be made accidentally, the researchers adopted the following clever de-

vice in order to avoid such a possibility. They fastened a fine-meshed net above the box, with a mesh being so fine that the ape could only poke a finger through it; the height of the box was so calculated that the ape, while able to touch the orange, could not hit it with force. Each touch could therefore only move the fruit a few centimetres forward. Chance was thus excluded from the solution. On the other hand this gave a possibility of studying exactly how the fruit was knocked out. Would the ape move the orange anyhow, so that its path would be built up from separate displacements that would accidentally take it to the edge of the box? Or would it guide the fruit by the shortest path to the exit from the box, i.e. would its action be built up of movements directed in a definite way rather than from chance ones? The animal itself gave the best answer to the question posed. Because the business of gradually shifting the orange took much time, and apparently tired the animal, it already, half-way through impatiently made a searching movement of the arm, i.e. tried to grab the fruit; having discovered that it was impossible to do so, it again began slowly pushing it until the orange was within range of its hand.[19]

Köhler considered that the main attribute distinguishing the behaviour of these animals from that of other members of the animal kingdom, and which brought it closest to the behaviour of man, was precisely that their operations were not shaped gradually through trial and error but arose suddenly, independently of previous experience, by insight as it were.[20] A second attribute of intellectual behaviour, derived from the first, he considered to be a capacity to remember the found solution 'once and for all', and to transfer it broadly to other conditions similar to the original ones. As regards the fact of apes' solving two-phase problems, Köhler and others following him consider that a combination of two moments underlies it: the animal's 'insight' and the transfer of a solution earlier found. They thus did not consider this fact to have any fundamental significance.

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[19] See: P. Guillaume, I. Meyerson. Recherches sur l'usage de l'instrument chez les singes. *Journal de psychologie normale et pathologique*, 1930, 3/4: 177-236.

[20] See: W. Köhler. The Mentality of Apes (Routlege & Kegan Paul, London, 1925; Penguin Books, London, 1957), pp 219, 265.

From that point of view, it is sufficient to explain the main fact, i.e. the fact of an animal's sudden finding of a way to solve the first, initial problem, in order to understand the whole peculiarity of apes' intellectual activity.

Köhler tried to explain this by anthropoid apes' having a faculty of correlating separate things, distinguishable from one another, in perception, so that they were perceived as part of a single 'integral situation' (Gestalt).

This property of perception itself, its structured character, is only a partial case, in Köhler's view, expressing the general 'Gestalt principle' that allegedly underlies not only the psyche of animals and man and their vital activity, but also the whole physical world.

From this point of view the 'Gestalt principle' can serve as an explanatory principle, but itself is then inexplicable and does not require explanation. The attempt to bring out the essence of intellect starting from this idealist 'Gestalt theory' is, it goes without saying, unsound. Quite clearly it is not sufficient to enlist the structured character of perception to explain the peculiarity of higher animals' behaviour. For, from the standpoint of the adherents of the 'Gestalt principle', structured perception is not only peculiar to the higher apes but is also peculiar to much less developed animals; intelligent behaviour, however, is not observed in the latter.

This explanation is also unsatisfactory from another aspect. By stressing the suddenness of the intellectual solution and isolating that fact from the content of an animal's experience, Köhler left a whole number of circumstances out of account that characterise the behaviour of apes in their natural environment.

Bühler, it seems, was the first to draw attention to the fact that there is something in common between an ape's drawing a fruit to itself by means of a stick, and pulling a fruit growing on a tree to itself by means of a branch. Attention was then drawn to the fact that the roundabout path observed in apes could also be explained by the fact that these animals, living in forests and passing from one tree to another, must constantly 'orient themselves' to the route in advance, or else they would find themselves in an impasse of the natural labyrinth formed by the trees. It is not accidental, therefore, that apes display a developed

faculty for solving problems in a 'roundabout way'.[21]

The idea that the explanation of apes' intellectual behaviour must be sought above all in its link with their normal species behaviour in their natural environment has been expressed more and more definitely of late in the works of psychologists and physiologists.

From that point of view an intellectual 'solution' is nothing more than the application in new conditions of a mode of activity phylogenetically developed. This transfer of a mode of action differs from the ordinary transfer of operations in other animals only in happening within wider limits.

Thus, according to this conception of the intellectual behaviour of apes, its main attributes distinguished by Köhler must be correlated with one another in the opposite order. Its special character (suddenness) must not be explained by the transfer of a found solution, but on the contrary the sudden solution of an experimental problem must itself be understood as the result of the animal's capacity for a broad transfer of operations.

That conception of apes' intellectual behaviour agrees well with certain facts, and has the virtue that it does not counterpose the animal's intellect to either its individual or species experience, and does not separate intellect from habit. But it also comes up against serious difficulties. First of all it is clear that neither the moulding of operations nor their transfer to new conditions of activity can serve as distinguishing attributes of the behaviour of higher apes, because both these moments are also common to animals at a lower stage of evolution. We observe both these moments, though in less clear form, in many other animals as well, viz., among mammals and birds. The difference in activity and psyche between the latter and apes, it turns out, is a purely quantitative one: a slower or quicker moulding of the operation, and narrower or broader transfers. But the behaviour of apes differs qualitatively as well from that of lower mammals. Their use of instruments and the special character of their operations are quite clear evidence of that.

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[21] See: Karl Bühler. Die geistige Entwicklung des Kindes (Fischer, Jena, 1930), p 22.

Furthermore, the conception of animals' intellect cited above leaves the main thing undisclosed, namely what is the wide transfer of actions observed in apes and what is the explanation of it.

To answer these questions we must again change the places of the features of animals' intellectual behaviour pointed out by Köhler, and make a third characteristic fact that in his opinion is of no fundamental importance the starting point of the analysis, namely apes' capacity to solve two-phase problems.

In two-phase problems the two-phased nature of *any* animal intellectual activity comes out particularly clearly. It is necessary first to pick up the stick and then to get the fruit. It is necessary first to push the fruit away, and then to go round the cage and reach for it from the opposite side. Touching the stick by itself leads to taking hold of it but not to seizure of the fruit that attracts the animal. It is the first phase. Unconnected with the next phase it lacks any biological sense whatsoever. It is a phase of preparation. The second phase—use of the stick—is already the phase of the realisation of activity toward a goal, directed to satisfying a given biological need of the animal. Thus, if we appoach the apes' solution of any of the problems given them by Köhler from this point of view it proves that each of them required two-phase activity: to pick up a stick—to pull the fruit to itself, to move away from the bait—to possess the bait, to turn the box over—to reach the fruit, and so on.

What is the essence of these two phases of the apes' activity? The first, preparatory phase is apparently not stimulated by the object to which it is directed, for example not by the stick itself. If the ape sees a stick in a situation that does not require its use, except, for example, a roundabout way, it will not, of course, try to take hold of it, which means that the ape does not associate this phase of the activity with the stick but with the stick's objective relation to the fruit. The reaction to this relationship is nothing other than preparation for the next, second phase of the activity, i.e. the phase of realisation.

What is this second phase? It is already directed to the object that immediately stimulates the animal, and is built up according to definite objective conditions, and consequently includes some operation or other that becomes a quite firm habit.

When we pass to the third, highest stage of animal evolution we thus observe a new complication in the structure of activity. The activity previously merged in a single process is now differentiated into two phases, one of preparation and one of accomplishment. The existence of a preparatory phase also constitutes a characteristic feature of intellectual behaviour. Intellect arises for the first time, consequently, when preparation of the possibility to perform some operation or habit commences.

An essential attribute of two-phase activity is that new conditions no longer evoke simply trial movements in the animal but trials of previously developed ways or operations. How, for example, does a hen behave when driven out of an enclosure? It rushes blindly from side to side, trying to find a way out, i.e. simply increases its motor activity, until finally a chance movement leads to success. Higher animals behave differently in face of a difficulty. They also make trials, but these are not trials of separate movements but are primarily trials of various operations or modes of activity. Thus an ape, faced with a locked box, first tries the habitual operation of pressing on the lever; when that does not work, it tries to gnaw a corner of the box; then it employs a new method, to get into the box through the slit in the door. Then follows an attempt to gnaw off the lever, which is succeeded by an attempt to pull it off by its hand; finally, when that does not work, it employs the next method, to try and turn the box over. [22]

This feature of apes' behaviour, which consists in their being able to solve one and the same problem in many ways, is most important evidence of their operations, like those of other animals at the same stage of evolution, having ceased to be connected in fixed way with the activity appropriate to a problem, and not requiring the new problem, for their transfer, to be directly similar to an earlier one.

Let us now consider intellectual activity from the aspect of animals' reflection of their environment.

In its outward expression the first, main phase of intellectual activity is directed to preparing for its second phase, i.e. is objectively governed by the next activity of the animal itself. Does that mean, however, that the animal has its next operation in mind, i.e. that it is capable

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[22] See: J. V. Buytendijk. *Op. cit.*

of imagining it? There is nothing to justify such a supposition. The first phase corresponds to the objective relation between things. This relation of the things must also be reflected by the animal, which means that in the transition to intellectual activity the form of animals' psychic reflection is altered in fact simply in a reflection of the relations of things (situations) arising as well as a reflection of things.

The character of the transfer also changes accordingly, and consequently also the character of the animals' generalisations. The transfer of an operation is now a transfer not only on the principle of the similarity of things (e.g. obstacles), with which the given operation was associated, but also on the principle of the similarity of relations, of the connections between things, to which it responds (e.g. branch—fruit). An animal now generalises the relations and connections of things. Its generalisations are formed, of course, exactly like the generalised reflection of things, i.e. during the activity itself.

The origin and evolution of animals' intellect has its anatomical and physiological basis in a further development of the cerebral cortex and its functions. What are the main changes in the cortex observable in the higher stages of the evolution of the animal kingdom? The new thing that distinguishes the brain of higher mammals from that of lower animals is the relatively much greater place occupied by the frontal lobe, which is developed through differentiation of its prefrontal fields.

Study of the intellect of higher apes indicates that man's thinking has its real preparation in the animal kingdom, and that in this respect, too, there is no insuperable gulf between man and his animal ancestors. While noting the natural continuity in the evolution of the psyche in animals and man, however, one must not exaggerate their similarity in any way, as certain contemporary zoopsychologists do who try in their experiments with apes to demonstrate the alleged antiquity and naturalness of such 'intellectual behaviour' as working for pay and money exchange.[23]

Attempts to counterpose the intellectual behaviour of apes sharply to the behaviour of their higher mammals are also wrong. We now have many facts at our disposal

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[23] See: J. B. Wolfe. Effectiveness of Token-Rewards for Chimpaneesz. *Comparative Psychological Monographs*, 1936, *12*: 1-72.

that indicate that two-phase activity can be discovered in many higher animals including dogs, raccoons, and even cats (in the last named, which belong to the 'lurking' animals, it is true only in a very special expression).

Intellectual behaviour, which is proper to higher mammals, and which attains especially high development in apes, is thus the upper limit of the evolution of the psyche, after which the history of the evolution of a psyche of a quite different, new type begins, peculiar only to man, i.e. the history of the evolution of human consciousness.

4. The General Features of the Psyche of Animals

The prehistory of human consciousness is, as we have seen, the long, complex process of the evolution of animals' psyche.

When we observe the whole road that its development has taken, its main stages and the main patterns governing it stand out distinctly.

The psyche of animals develops during their biological evolution and is governed by the general laws of that process. Each new stage in psychological evolution has as its basis a transition to new external conditions of animals' existence and a new step in the complication of their physical organisation.

Adaptation to a more complex, physically shaped environment leads to differentiation of the primitive nervous system in animals and of special organs of sensitivity. An elementary sensory psyche also arises on that basis, i.e. a capacity to reflect the separate properties of the environment.

Subsequently, with the transition of animals to a land mode of existence, and the development of the cerebral cortex caused by that step, psychic reflection of the wholeness of things by animals arises, and a perceptive psyche originates.

Finally, further complication of the conditions of existence, which leads to the evolution of ever more perfected organs of perception and action and an ever more perfected brain, creates the possibility in animals of their sense perception of the objective relations of things in the form of object 'situations'.

We thus see that the evolution of the psyche is governed by animals' need to adapt to the environment, and that psychic reflection is a function of the appropriate organs formed during that adaptation. We must specially stress here that psychic reflection is by no means solely a 'purely subjective', secondary phenomenon of no real significance in animals' life and in their struggle for existence; on the contrary, as we have already said, the psyche arises and evolves in animals precisely because they could not orient themselves otherwise in their environment.

The evolution of life thus leads to a change in animals' physical organisation, to the emergence in them of organs like sense organs, motor organs, and a nervous system, whose function is to reflect the reality around them. What does the character of this function depend on? What governs it? Why is it expressed in some conditions, for example, in the reflection of separate properties and in other in a reflection of the wholeness of things?

We have found that this depends on the objective structure of animals' activity in practice connecting the animal with the world around it. In responding to a change in the conditions of existence, animals' activity alters its structure, its 'anatomy' so to speak. That also creates a need for such a change in the organs and their functions which leads to the emergence of a higher form of psychic reflection. We can express this in brief as follows: whatever the objective structure of an animal's activity, such will also be the form of its reflection of reality.

The evolution of animals' reflection of their environment, however, also, as it were, lags behind the evolution of their activity. The simplest activity governed by the objective links of the affective properties and correlating the animal with a complex environment formed of things thus conditions the development of elementary sensations, which reflect only separate influences. The more complicated activity of vertebrates, determined by the physical relationships of things and situations, is linked with the reflection of whole things. Finally, when a 'phase of preparation' objectively determined by the possibilities of the animal's further action is differentiated at the stage of intellect, the form of the psyche is characterised by reflection of the physical relations of things and their physical situations.

The development of the form of psychic reflection is thus, as it were, a step downward shifted in relation to the evolution of the structure of animals' activity, so that there is never a direct correspondence between them.

Or rather, this correspondence can only exist as a moment marking a transition in evolution to the next, higher stage. Elimination of said disparity through the emergence of a new form of reflection opens up new possibilities of activity, which acquires an ever higher structure, with the result that a disparity and contradiction again arises between them, but now already at a higher level.

The material basis of the complex process of the evolution of animals' psyche is thus the formation of their 'natural implements' of activity, i.e. their organs and the functions inherent in these organs. The evolution of organs and the functions of the brain corresponding to them,which takes place at each stage of the evolution of animals' activity and psyche gradually prepares the possibility of a transition to a new, higher structure of their activity as a whole; the change in the general structure of animals' activity emerging with this in turn creates a need for further evolution of individual organs and functions, which now already seems to take a new direction. This change as it were in the very direction of the evolution of separate functions in the transition to a new structure of activity and to a new form of reflection of reality shows up very distinctly.

At the stage of the elementary sensory psyche, for instance, a memory function takes shape on the one hand in the direction of fixing the links of separate affective properties, and on the other hand as a function fixing the simplest motor connections. This function of the brain evolves at the stage of the perceptive psyche in the form of a memory of things and on the other hand in the form of the evolution of a capacity to form motor habits. Finally, at the stage of intellect its evolution takes yet another new direction, toward the development of a memory of complex relationships and situations. Similar qualitative changes are observed also in the evolution of other individual functions.

In reviewing the evolution of the animal psyche we first of all stressed the differences that exist between its forms. Now we have to distinguish what these different forms have in common and what makes the activity of animals and their

psyche qualitatively different from human activity and human consciousness.

The first difference between any animal activity and human activity is that the former is instinctive, biological activity.[24] In other words, animal activity can only be realised in relation to an object of vital, biological need or in relation to affective properties and things and their relationships (situations), that acquire the sense for animals of something that is connected with satisfying a certain biological need. Any change in animal activity therefore expresses in itself a change in the actual influence stimulating this activity, and not in the vital relationship itself that is realised by it. In ordinary experiments in forming a conditioned reflex in animals, for example, no new relation arises of course; no new need develops in it, and if the animal now responds to the conditioned signal that is only because this signal now acts on it in the same way as an unconditioned stimulus. If we analyse any of an animal's diverse activities in general, we can always establish a certain biological relation that it realises, and consequently find the biological need underlying it.

Animals' activity thus always remains within the limits of their instinctive, biological relations with nature. That is a general law of animal activity.

In that connection the possibility of animals' psychic reflection of the reality around them is also limited in principle. Because an animal enters into an interaction with a variety of objects of the environment affecting it, transferring its biological relations to them, it reflects only those aspects and properties of them that are connected with realising these relations.

Thus, whereas the figure of a triangle appears in man's consciousness irrespective of the actual relation to it, and is primarily characterised objectively, i.e. by the number of angles, etc., for an animal capable of distinguishing shape this figure is only distinguishable in so far as it has biological sense. A shape that is distinguished by an animal among several others will not be reflected by it apart from its appropriate biological relation. When an animal therefore has no instinctive relation with a given thing or a given

[24] From here on we shall use the term 'instinctive' in its broadest sense as directly natural.

affective property, and the thing has no connection with realisation of this relation, the thing itself does not in that case exist, as it were, for the animal. In its activity it displays indifference to the influences concerned, which, although they *could be* an object of its perception, will *never*, however, *become* such in these conditions.

That explains the limited character of the world perceived by animals within the narrow confines of their instinctive relations. In contrast to man there is thus no stable objective object-reflection of reality in animals.

Let us explain this by an example (see Fig. 29). When

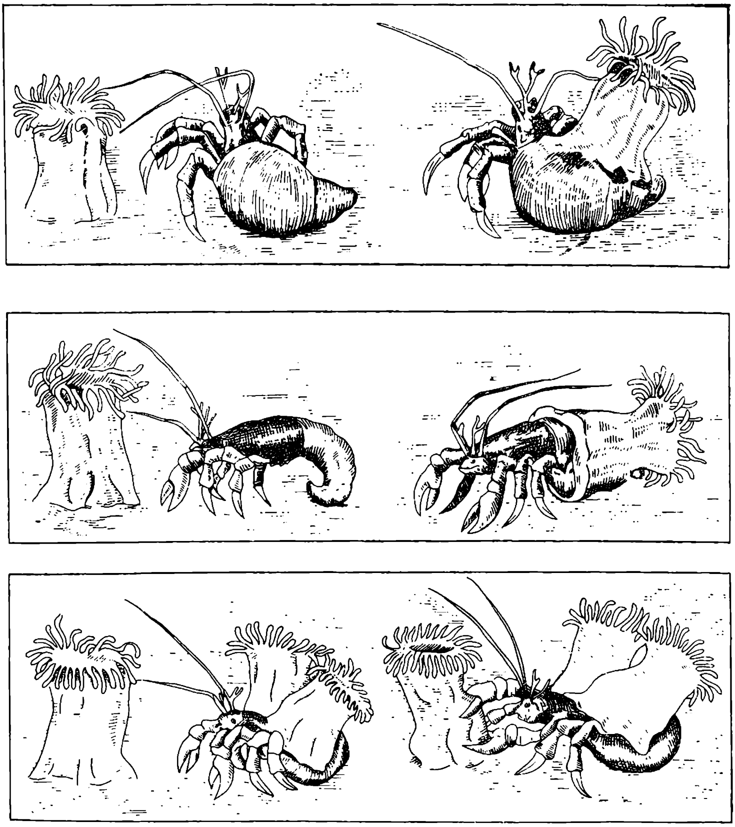

Fig. 29. Hermit crab and sea-anemone (*Actinia*) (after Uexküll and Kriszat).

a hermit crab that usually carries a sea-anemone on its shell is looking for a sea-anemone and finds one, it hoists it onto its shell (the top pair of drawings). When it moults the shell it picks up sea-anemone as a possible defence for its abdomen, which now lacks protection, and tries to back into it (middle drawings). Finally, when the crab is hungry, the biological sense of a sea-anemone for it again changes, and it begins to eat same (lower drawings).[25]

On the other hand, when an object of the environment always appears to an animal inseparable from its instinctive need, its relation to the object understandably never exists for it as such, as something separate from the object. That, too, is the opposite of what characterises human consciousness. When man enters into any relation with a thing, he distinguishes between the objective subject-matter of the relation on the one hand and, on the other hand, his relation to it *per se*. And that division does not exist in animals. 'The animal,' Marx and Engels said, 'does not "*relate*" itself to anything, it does not "relate" itself at all.'[26]

Finally, we must note yet another essential feature of the psyche of animals that distinguishes it qualitatively from human consciousness. This is the fact that animals' relations to each other are the same in principle as their relations to other external objects, i.e. also belong exclusively to the realm of their instinctive, biological relations. That is connected with the fact that animals have no society. We can observe the activity of a few, sometimes of many, animals together, but we never observe joint activity among them, i.e. joint in the sense of the word as we employ it when speaking of men's activity. For example, special observations of ants that are dragging a relatively big object along together—a twig of some sort or a big insect—indicate that the common, final path that their burden follows is not the result of these animals' joint, organised actions but is the result of the mechanical addition of the efforts of individual ants, each one acting as if it were carrying the object independently. The same is clearly visible in the most highly organised animals, i.e. in apes. When several

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[25] See: Jacob von Uexküll, Georg Kriszat. *Streifzüge durch die Umwelten von Tieren und Menschen* (Rowohlt, Hamburg, 1958), pp 66-67.

[26] Karl Marx and Frederick Engels. The German Ideology. *Collected Works*, Vol. 5 (Progress Publishers, Moscow, 1976), p 44.

apes are faced with a problem requiring one box to be placed on another so that they can climb up on them and so reach a banana hanging high above them, each of the animals acts (as observations have shown) without considering the others. With such 'joint' action, therefore, a struggle for a box often develops, and a clash and fight between the animals, so that the 'structure' remains unbuilt, despite each ape separately knowing how, though not very dexterously, to pile one box on the other and clamber up them.

In spite of these facts some writers consider that there is allegedly a division of labour among animals. For that they usually point to well-known examples from the life of bees, ants, and other 'social' animals. In fact, however, there is no real division of labour in all these cases, of course, as labour itself does not exist among them, i.e. a process that is by its very nature social.

Although separate individuals among some animals do perform different functions in association, directly biological factors underlie this difference of function. This is indicated both by the strictly defined, fixed character of the functions themselves (e.g. 'worker' bees build honeycomb, and later the queen bee lays eggs in them) and by the just as fixed character of their sequence (e.g. the consecutive change of functions of 'worker' bees). The division of functions in associations of higher animals, e.g. in a troop of apes, is of a more complex character but it is determined in that case also by directly biological causes and not at all by the objective conditions that have taken shape in the development of the activity itself of the given animal association.

The features of animals' relations with one another also determine the features of their 'speech'. As we know animals' communication is often expressed by one animal's affecting others by means of vocal sounds. That justifies our speaking of animals' speech. It applies, for example, to the signals given by sentry birds to the other members of the flock.

In this case, however, do we have a process similar to the oral communication of man? There is undoubtedly a certain similarity between them. But inwardly the processes are basically different. Man expresses a certain objective content in his speech and does not respond to speech addressed to him simply as sound stably associated with a definite phenomenon, but rather to the reality reflected in the speech. We have quite another case in the vocal commu-

nication of animals. It can readily be demonstrated that an animal reacting to the voice of another animal, responds not to what the vocal signal objectively reflects but to the signal itself, which has acquired a certain biological sense for it.

If, for instance, we pick a chick up and restrain it by force it begins to struggle and cheep; its cheep attracts the hen to it, which rushes in the direction of the sound and responds to it by a special kind of clucking. This vocal behaviour of a chick and hen is outwardly similar to oral communication. But the process is in fact of quite a different nature. The chick's cry is an innate, instinctive (unconditioned reflex) reaction, belonging to what are called expressive movements that do not indicate and do not signify any definite object, action, or phenomenon; they are only associated with a certain state of the animal evoked by external or internal stimuli. The hen's behaviour, in turn, is also a simple, instinctive response to the chick's cry, which acts on it just as such, viz., as a stimulus that evokes a definite instinctive reaction, and not as something meaningful, i.e. reflecting some phenomenon of objective reality. That can easily be confirmed by the following experiment: if we put the restrained chick, which continues to cheep, under a thick glass cover that deadens the sounds, the hen, which can distinctly see the chick but no longer hears its cheeping, ceases to display any activity whatsoever in regard to it; the sight of the struggling chick in itself leaves it indifferent. The hen thus reacts not to what the chick's cheeping objectively means, in this case to a danger threatening it, but to the sound of the cheeping (see Fig. 30).

In principle the vocal behaviour of even more highly developed animals remains the same in character, for example that of apes. As the findings of Yerkes and Learned indicate, it is impossible to teach apes real speech.[27]

It does not follow from the fact that animals' vocal behaviour is instinctive that it is not associated with their psychic reflection of external objective reality, but as we have already said, the objects of their environment are inseparable for animals from their relation itself to these objects. An animal's expressive activity is therefore also

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[27] See: R. M. Yerkes, B. M. Learned. *Chimpanzee Intelligence and Its Expression* (Williams & Wilkins, Baltimore, 1925).

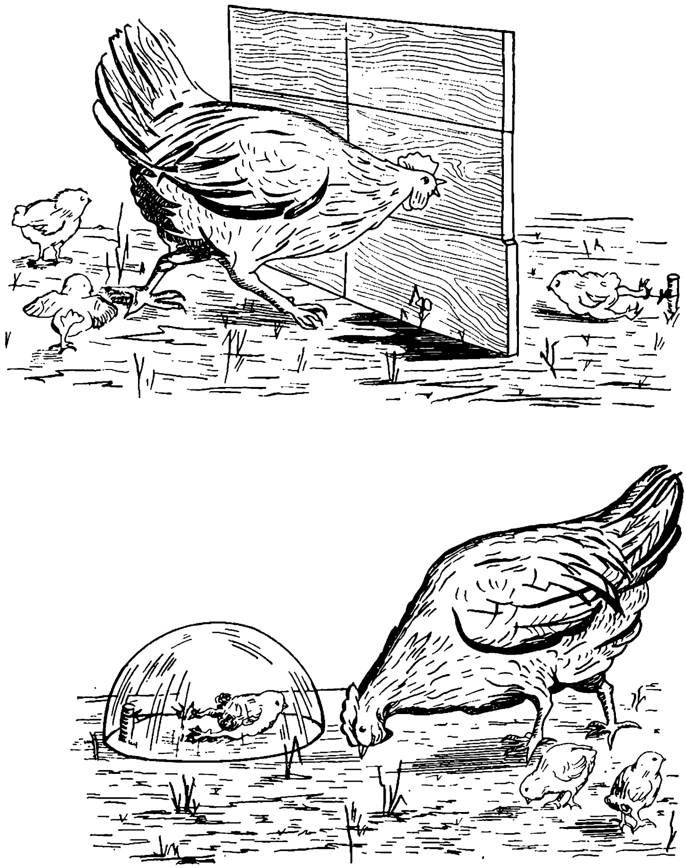

Fig. 30. Hen and chick (after Uexküll).

never related to the objective thing itself. That is clearly seen from the fact that it repeats the very same vocal reaction when the biological sense of the given influences is identical for it, although the objective affective things may be completely different, rather than when the objects are identical in character. Birds that live in flocks, for example, have specific calls that warn the flock of danger. These cries are reproduced by the bird whenever it is frightened by something. At the same time it is quite irrelevant what

precisely is affecting it in the case in point: one and the same call signals the appearance of a man, the appearance of a predator, or simply some sort of unusual noise. These calls are consequently linked with some phenomenon or other of reality, not by their objectively similar attributes, but simply by the similarity of the animal's instinctive relation to them. They are not related to the objects of the environment themselves but are associated with the animal's subjective states that arise in connection with these objects. In other words the animal cries mentioned lack a stable, objective, thing significance.

The intercourse of animals is thus also completely confined to their instinctive activity both as regards its content and as regards the character of the way its concrete processes are performed.

Man's psyche, human consciousness, is a quite different form of psyche, characterised by completely other features.

The transition to human consciousness, which is underlain by a transition to human forms of life, and to human labour activity, social by its very nature, is not simply associated with a change in the fundamental structure of activity and the rise of a new form of reflecting reality; man's psyche is not only emancipated from those features that are common to all the stages of animals' psychic evolution that we have considered, and has not only acquired qualitatively new features, but (and this is the main point) the laws themselves that govern its evolution were altered with the transition to man. While the general laws governing the laws of the psyche's evolution were those of biological evolution throughout the animal kingdom, with the transition to man the evolution of the psyche began to be governed by laws of *socio-historical development*.

II. The Origin of Human Consciousness

1. The Conditions for the Emergence of Consciousness

The transition to consciousness is the beginning of a new, higher stage in the evolution of the psyche. In contrast to the psychic reflection peculiar to animals, conscious reflec-

tion is reflection of material reality in its separateness from the subject's actual attitudes to it, i.e. reflection that distinguishes its objective stable properties.

The image of reality does not merge in consciousness with the subject's experience; in consciousness what is reflected appears to the subject as 'impending', which means that when I am aware, for example, of this book, or even only of my thought of a book, the book itself does not merge in my consciousness with my experience relative to the book, or the very idea of the book with my experience of this idea.

The distinguishing of the reality reflected in man's consciousness as objective has as another aspect the distinguishing of the world of inner experiences and the possibility of developing self-observation on that basis.

The task facing us is also to trace the conditions that give rise to this higher form of psyche, i.e. human consciousness.

The cause underlying the humanising of man's animal-like ancestors is the emergence of labour and the formation of human society on its basis. 'Labour,' Engels wrote, 'created man himself'.[28] Labour also created man's consciousness.

The origin and development of labour, this first and basic condition for the existence of man, led to a change in his brain, his organs of external activity, and his sense organs, and their humanisation.

> First labour, after it and then with it speech — these were the two most essential stimuli under the influence of which the brain of the ape gradually changed into that of man, which for all its similarity to the former is far larger and more perfect.[29]

The main organ of man's labour, his hand, could only attain its perfection through the development of labour itself.

> Labour, adaptation to ever new operations, the inheritance of muscles, ligaments and, over longer periods of time, bones that had undergone special development and the ever-renewed employment of this inherited finesse in new, more and more complicated operations, have given human hand the high degree of perfection required to conjure into being the pictures of a Raphael, the statues of a Thorwaldsen, the music of a Paganini.[30]

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[28] Frederick Engels. *Dialectics of Nature*. Translated by Clemens Dutt (Progress Publishers, Moscow, 1976), p 170.

[29] *Ibid.*, p 174.

[30] *Ibid.*, p 172.

When we compare the maximum size of the simian skull and of the skull of primitive man, we find that the latter's brain is more than twice as big as that of the most highly developed modern species of ape (1400 cc and 600 cc).

The difference in the size of the brain of apes and man comes out even more sharply when we compare their weight; the difference is almost fourfold: the brain of an orang-utan weighs 350 grammes, and that of man 1400 grammes.

Man's brain has a much more complicated, much more developed structure than the brain of the higher apes.

New areas of the cortex, not fully differentiated in the brain of apes, which later achieved full development in the brain of modern man, are already distinguishable in Neanderthal man, as casts of the inner surface of his skull indicate. Such are the areas numbered 44, 45, and 46 in Brodmann's system, in the frontal lobe, areas 39 and 40 in the parietal lobe, and areas 41 and 42 in the temporal lobe (see Fig. 31).

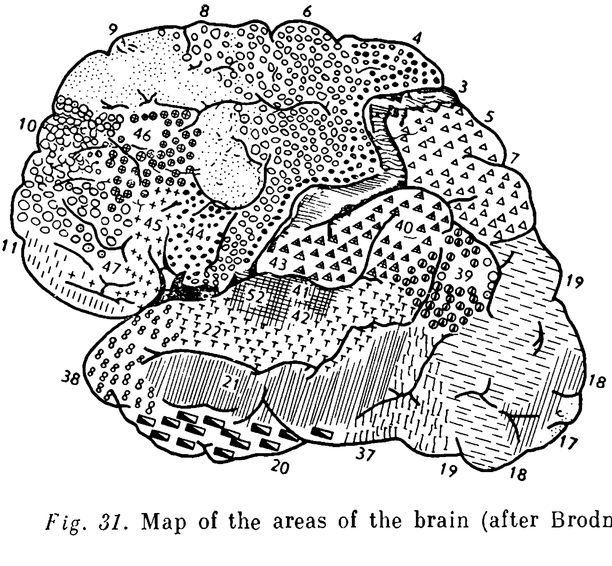

Fig. 31. Map of the areas of the brain (after Brodmann).

It is very clear how new, specifically human features are reflected in the structure of the cerebral cortex when what we call the projection motor area is investigated (area 4 in Fig. 31). When various points in this area are carefully

stimulated by an electric current, then, from the contraction of various groups of muscles elicited by this stimulation, the location of the projection of one organ or another in it can be exactly represented. Penfield expressed the results of these experiments in the form of the schematic, and of course arbitrary, drawing that we reproduce below (see Fig. 32). It is clear from this figure, which is drawn to a certain scale, what a relatively big surface is occupied in the human brain by the projections of such motor organs as the hands, and especially by the organs of speech (the muscles of the mouth, tongue, and organs of the larynx), whose functions are developed particularly intensively in the conditions of human society (labour, speech communication).

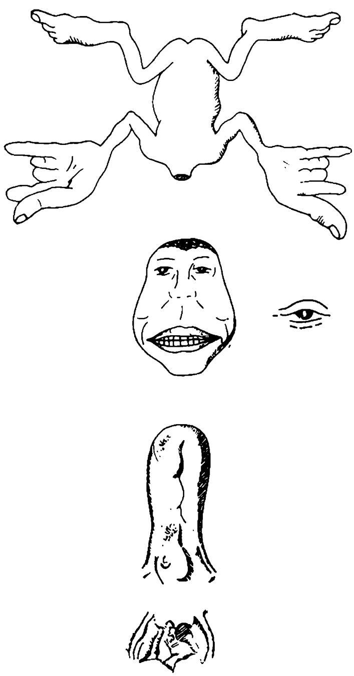

Fig. 32. Penfield's 'brain man'.

Man's sense organs were also perfected through labour and in connection with the development of the brain. Like the organs of external activity they acquired qualitatively new features. The sense of touch became more exact, the humanised eye began to note more in things than the eye of the most far-sighted birds, hearing developed capable of perceiving very fine differences and similarities in the sounds of human, articulated speech.

The development of the brain and sense organs in turn had a reverse effect on labour and speech, giving both 'an ever-renewed impulse to further development.'[31]

The separate anatomical and physiological changes

[31] Frederick Engels. *Op. cit.*, p 174.

created by labour necessarily also entailed a change in the organism as a whole by virtue of the natural interdependence of the development of organs. The origin and development of labour thus led to a change in man's whole physical appearance and in his whole anatomical and physiological organisation.

The rise of labour was prepared by the whole preceding course of evolution, of course. The gradual transition to an upright posture, rudiments of which are distinctly observed even in the anthropoid apes that now exist, and the forming in connection with that of specially mobile anterior extremities adapted to grasping objects, and more and more freed from the function of walking, which was due to the mode of life led by man's animal forebears—all created the physical preconditions for the possibility of performing complicated labour operations.

The labour process was also prepared for from another aspect. It was only possible for labour to emerge in animals that lived in whole groups and which had sufficiently developed forms of joint life, although those forms were, of course, very remote even from the most primitive forms of human, social life. The interesting research carried out by Voitonis and Tikh at the Sukhumi nursery indicates what a high level of development can be achieved in the forms of animals' joint activity. As their work has shown there is already an established system of mutual relations within a troop of apes and a peculiar hierarchy with a correspondingly very complex system of intercourse. In addition this work made it possible once more to confirm that, in spite of all the complexity of the internal relations within the ape tribe, they are limited just the same to directly biological relations and are never governed by the objective, material content of the animals' activity.

An essential precondition of labour, finally, was also the existence among the highest members of the animal kingdom, as we have seen, of very developed forms of the psychic reflection of reality.

In the aggregate all these moments also constituted the main conditions by which, in the course of subsequent evolution, labour, and human society based on labour, could arise.

What is this specific human activity that we call labour?

Labour is the process that links man with nature, the process of man's action on nature.

Labour (Marx wrote) is, in the first place, a process in which both man and Nature participate, and in which man of his own accord starts, regulates, and controls the material re-actions between himself and Nature. He opposes himself to Nature as one of her own forces, setting in motion arms and legs, head and hands, the natural forces of his body, in order to appropriate Nature's productions in a form adapted to his own wants. By thus acting on the external world and changing it, he at the same time changes his own nature. He develops his slumbering powers and compels them to act in obedience to his sway.[32]

The two following features are above all typical of labour. The first is the use and making of tools. 'Labour,' Engels said, 'begins with the making of tools.'[33]

The second feature of the labour process is that it is performed in conditions of joint, collective activity, so that man functions in this process not only in a certain relationship with nature but also to other people, members of a given society. Only through a relation with other people does man relate to nature itself, which means that labour appears from the very beginning as a process mediated by tools (in the broad sense) and at the same time mediated socially.

Man's use of tools also has a natural history of its preparation. There are already the rudiments of tool activity among certain animals as we know, in the form of the use of external means with whose aid they perform separate operations (e.g. an ape's use of a stick). These external means—animals' 'tools'—differ qualitatively, however, from man's true tools, the implements of labour.

The difference between them by no means consists solely in the animal's using his 'tool' more seldom than primitive men. Even less does their difference consist in differences simply in their outward form. We can only bring out the real difference between human tools and animals' 'tools' by making an objective review of the activity itself in which they are included.

However complex animals' 'tool' activity, it never has the character of a social process, is not performed collectively, and does not itself govern a relationship of community among the individuals performing it. On the other hand,

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[32] Karl Marx. *Capital*, Vol. 1. Translated by Samuel Moore and Edward Aveling (Progress Publishers, Moscow, 1978), p 173.

[33] Frederick Engels. *Op. cit.*, p 176.

however complicated the instinctive contact between the individuals who make up an animal association, it is never built on the basis of their 'productive' activity, does not depend on it, and is not mediated by it.

In contradistinction, human labour is social activity from the beginning, based on the co-operation of individuals, assuming a technical division, even though rudimentary, of labour functions; labour consequently is a process of action on nature linking together its participants, and mediating their contact.

> In production, men enter into relation not only with nature. They produce only by co-operating in a certain way and mutually exchanging their activities. In order to produce, they enter into definite connections and relations with one another and only within these social connections and relations does their relation with nature, does production, take place.[34]

It is sufficient, in order to comprehend the concrete significance of this fact for the development of the human psyche, to analyse how the structure of activity is altered when it is performed in conditions of collective labour.

Already at the earliest time in the evolution of human society, a division of the previously single process of activity between the separate participants in production inevitably arose. Originally this division seemingly had a chance, impermanent character. In the course of subsequent evolution it took shape already as a primitive technical division of labour.

It now fell to the lot of some individuals, for example, to maintain the fire and to cook food on it, and of others to procure the food itself. Some of those taking part in the collective hunt fulfilled the function of pursuing game, others the function of waiting for it in ambush and attacking it.

This led to a decisive, radical change in the very structure of the activity of the individuals taking part in the labour process.

We saw above that any activity realising animals' directly biological, instinctive relations with the nature around them, is characterised by its always being directed to objects of biological need and stimulated by those objects. There is

[34] Karl Marx. Wage Labour and Capital. In: Karl Marx, Frederick Engels. *Collected Works*, Vol. 9 (Progress Publishers, Moscow, 1977), p 211.

no activity in animals that does not respond to some sort of direct biological need, that is not evoked by an effect with biological meaning for them, i.e. the sense of an object that satisfies a given need of theirs, and that would not be directly aimed in its final link at that object. The object of animals' activity, as we have already said, and its biological motive always merge in them, and always coincide with one another.

Let us now examine the fundamental structure of the individual's activity in the conditions of a collective labour process from this standpoint. When a member of a group performs his labour activity he also does it to satisfy one of his needs. A beater, for example, taking part in a primaeval collective hunt, was stimulated by a need for food or, perhaps, a need for clothing, which the skin of the dead animal would meet for him. At what, however, was his activity directly aimed? It may have been directed, for example, at frightening a herd of animals and sending them toward other hunters, hiding in ambush. That, properly speaking, is what should be the result of the activity of this man. And the activity of this individual member of the hunt ends with that. The rest is completed by the other members. This result, i.e. the frightening of game, etc. understandably does not in itself, and may not, lead to satisfaction of the beater's need for food, or the skin of the animal. What the processes of his activity were directed to did not, consequently, coincide with what stimulated them, i.e. did not coincide with the motive of his activity; the two were divided from one another in this instance. Processes, the object and motive of which do not coincide with one another, we shall call 'actions'. We can say, for example, that the beater's activity is the hunt, and the frightening of game his action.

How is it possible for action to arise, i.e. for there to be a division between the object of activity and its motive? It obviously only becomes possible in a joint, collective process of acting on nature. The product of the process as a whole, which meets the need of the group, also leads to satisfaction of the needs of the separate individual as well, although he himself may not perform the final operations (e.g. the direct attack on the game and the killing of it), which directly lead to possession of the object of the given need. Genetically (i.e. in its origin) the separation

of the object and motive of individual activity is a result of the exarticulating of the separate operations from a previously complex, polyphase, but single activity. These same separate operations, by now completing the content of the individual's given activity, are also transformed into independent actions for him, although they continue, as regards the collective labour process as a whole, of course, to be only some of its partial links.

The natural prerequisites of this exarticulation of the separate operations, and of their acquiring a certain independence in individual activity, are obviously the two following main (though not the sole) moments. The first of these moments is the frequently joint character of instinctive activity and the existence of a primitive 'hierarchy' of relations between individuals that is observed in associations of higher animals, for example among apes. The other very important moment is the separation in animals' activity that still continues to retain all its integrity, of two different phases—a phase of preparation and a phase of realisation, which may be considerably separated from each other in time. Experiments have shown, for example, that a forced break in activity in one of its phases makes it possible to postpone animals' subsequent reaction only a very little, while a break between phases gives a postponement ten or even a hundred times as long in the same animal (Zaporozhets' experiments).

In spite of the existence of an undoubted genetic link between the two-phase intelligent activity of higher animals and the activity of the individual man taking part in a collective labour process as one of its links, however, there is a vast difference between them, a difference that is rooted in the difference between the objective links and the relations that underly them, to which they correspond, and which are reflected in the psyche of the acting individuals.

The peculiarity of animals' two-phase intelligent activity consists, as we have seen, in the link between its two (or even several) phases being determined by physical, material links and relations (spatial, temporal, and mechanical). In animals' natural conditions of existence, furthermore, these are always natural links and relations. The psyche of higher animals accordingly has a capacity to reflect these material, natural links and relations.

When an animal, in taking a roundabout method, first

turns away from the bait and only then seizes it, this complicated activity is governed by the spatial relations of the situation perceived by the animal; the first part of the path, the first phase of the activity, naturally presents the animal of necessity with the possibility of performing the second phase.

The form of human activity that we considered has a decidedly different objective basis.

A beater's frightening of game leads to satisfaction of his need for it not at all because such are the natural conditions of the given material situation; rather the contrary, these conditions are such in normal cases that the individual's frightening of game eliminates his chance of catching it. In that case what unites the direct result of this activity with its final outcome? Obviously, nothing other than the given individual's relation with the other members of the group, by virtue of which he gets his share of the bag from them, i.e. part of the product of their joint labour activity. This relationship, this connection is realised through the activity of other people, which means that it is the activity of other people that constitutes the objective basis of the specific structure of the human individual's activity, means that historically, i.e. through its genesis, the connection between the motive and the object of an action reflects objective social connections and relations rather than natural ones.

The complex activity of higher animals governed by natural material connections and relations is thus converted in man into activity that is governed by connections and relations that are primordially social. That also constitutes the direct reason why a specifically human form of reflection of reality, human consciousness, arises.

The separation of an action necessarily presupposes the possibility of the active subject's psychic reflection of the relation between the objective motive and the object of the action. Otherwise the action is impossible and lacks any sense for its subject. Thus, to return to our earlier example, it is obvious that the beater's action is possible only on condition of his reflecting the link between the expected result of the action performed by him and the end result of the hunt as a whole, i.e. the ambushing and killing of the fleeing animal, and finally the eating of it. Originally this link figures for man in its still sense-perceptory form, i.e. in the form of the real actions of the other participants in the work. Their actions also give sense to the object of the

beater's action. Conversely it is the same: only the beaters' actions justify and give sense to the actions of the people who ambush the game; were it not for the beaters' action, the making of an ambush would be senseless and unjustified.

We thus once more come up against the relation, the connection that determines the direction of activity. This relation, however, differs at bottom from those that govern the activity of animals. It is created in the joint activity of people, and is impossible without that. The goal to which the action governed by this new relation is directed cannot in itself have any direct biological sense for man, and sometimes contradicts it. The frightening of game, for example, in itself is biologically senseless; it acquires sense only in the conditions of collective labour. These conditions also convey a human, rational sense to the action.

Thus, together with the birth of action, this main 'unit' in human activity, there also arises the main unit, social in nature, of the human psyche, i.e. the rational meaning for man of that which his activity is directed to.

We must dwell specially on that, because it is a most important point for concrete, psychological understanding of the genesis of consciousness. Let us explain our idea once more.

When a spider rushes toward a vibrating object its activity is governed by a natural relation that associates vibration with the food property of an insect that has been caught in the web. Because of that relation vibration has acquired the biological sense of food for the spider. Although the link between the characteristic of an insect to cause a spiderweb to vibrate and its capacity to serve as food in fact determines the spider's activity, it is hidden from the latter as a connection, as a relation, and 'does not exist for it'. Therefore, when a spider is presented with any vibrating object, e.g. a tuning fork, it rushes equally toward it.

The beater frightening game also subordinates his action to a certain connection or relation, namely one that links the flight of the game with its subsequent capture, but the relation underlying this link is no longer a natural one, but a social one, namely, the beater's labour link with the other participants in the collective hunt.

As we have already said, the sight of game cannot in itself of course prompt frightening of it. For man to take on the function of a beater it is necessary for his actions to have

a relation that connects their result with the outcome of the collective activity; it is necessary for this relation to be subjectively reflected by him so that it becomes 'existent for him'; it is necessary in other words for the sense of his action to be revealed to him, to be comprehended by him. Consciousness of the sense of an action also comes about in the form of reflection of its object as a conscious goal.

Now the link between the object of an action (its objective) and what stimulates it (its motive) is revealed for the first time to the subject. It is revealed to him in its directly sensory form, i.e. in the form of the activity of a human work group. This activity is also now no longer reflected in man's head in its subjective oneness with the object but as the subject's objective, practical relation with it. In the conditions being considered this is always, of course, a collective subject and the relations of the individual participants in the work are consequently originally reflected by the individuals only to the extent that their relations coincide with those of the group as a whole.

The most important, decisive step, however, proves with that to have already been taken. Men's activity is now separated from objects in their consciousness. They begin to be aware of it precisely as their relation. That means, however, that nature itself, too, i.e. the objects of the world around them, is now also differentiated for them and appears in its stable relation with the group's needs and activity. Man thus perceives food, for example, as the object of a definite activity—searches, hunting, preparation—and at the same time as an object that satisfies certain of men's needs irrespective of whether the person concerned directly experiences a need for it and whether it is now the object of his own activity. He can consequently differentiate it from other objects of activity not only in practice, in activity itself, and depending on an actual need, but also 'theoretically', i.e. it can be retained in consciousness, can become an 'idea'.

2. The Forming of Thought and Speech

Above we traced the general conditions needed for the rise of consciousness. We found them in the conditions of men's joint labour activity. We saw that only in those conditions

is the content of what man's action is directed to is singled out from its oneness with his biological relations.

Another problem faces us now, that of the forming of those special processes with which the conscious reflection of reality is connected.

We have seen that consciousness of the objective of a labour action presupposes reflection of the objects to which it is directed, independently of the subject's actual relation to them.

Where do we find these special conditions of such reflection? We again find them in the labour process itself. Labour not only alters the general structure of man's activity, not only gives rise to goal-directed actions, but in the process also qualitatively alters the content of the activity, what we call operations.

This alteration of operations takes place in connection with the origin and evolution of tools. Man's labour operations are remarkable in fact in that they are performed with the aid of tools or instruments of labour.

What are tools?

> An instrument of labour is a thing, or a complex of things, which the labourer interposes between himself and the object of his labour, and which serves as the conductor of his activity.[35]

A tool is thus an object by which a labour action, labour operations, are performed.

The making and use of tools is only possible in connection with consciousness of the objective of the labour action, but use of a tool itself leads to consciousness of the object of the action in its objective properties. The use of an axe not only corresponds to the objectives of a practical action but at the same time objectively reflects the properties of the object, i.e. the object of labour, onto which its action is directed. The blow of an axe subjects the material that constitutes this object to an unfailing test; it makes a practical analysis and generalisation of the objective properties of objects according to a certain attribute objectivised in the tool itself. It is thus the tool that is the carrier or vector of the first real conscious, rational abstraction, the first real conscious, rational generalisation.

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[35] Karl Marx. *Capital*, Vol. 1 (Progress Publishers, Moscow, 1978), p 174.

We must, furthermore, allow for yet another circumstance that characterises a tool, that is that a tool is not only an object that has a certain form and possesses certain physical properties, but it is, at the same time, a social object, i.e. an object that has a certain mode of use developed socially in the course of collective labour and reinforced by same. When we look at an axe, for example, as a tool and not simply as a physical body, it is not only two interconnected parts (the part we call the helve, and the one that is the working part proper), but is at the same time a socially developed means of action, namely the labour operations that have been given material shape, are crystallised, as it were, in it. That is why to handle a tool means not simply to hold it but also to know how to use it.

The 'tool' of animals also implements a certain operation, but this operation is not assigned to it, not fixed for it. As soon as a stick has fulfilled its function in the hands of an ape it is once more converted into an object of indifference for it. It does not become the permanent bearer of a given operation. Therefore, incidentally, animals also do not make their tools specially, and do not keep them. The human tool, on the contrary, is one that is made or searched out specially, that is preserved by man, and itself preserves the mode of action performed by him.

Thus, simply by considering tools as instruments of man's labour activity, we bring out their real difference from the 'tools' of animals. The animal finds in a tool only the natural possibility to implement its instinctive activity, as, for example, to pull fruit to itself. Man sees in a tool a thing that carries within it a certain, socially developed mode of action.

Even with an artificial, specialised human tool an ape therefore acts only within the narrow limits of the instinctive modes of its activity. In the hands of man, on the contrary, the simplest natural object often becomes a real tool, i.e. realises a genuinely implemental, socially developed operation.

With animals a 'tool' does not create new operations of any sort; it is subordinated to their natural movements, being incorporated into their system. With man the opposite occurs; his hand itself is incorporated into the socially developed system of operations fixed in the tool, and is subordinated to it. This has been demonstrated in detail

by contemporary research. If we can say in relation to apes, therefore, that the natural evolution of their hands has determined their use of a stick as a 'tool', in relation to man we have every ground for saying that his instrumental activity itself created the specific features of his hand.

A tool is thus a social object, is the product of social practice and of social labour experience. The generalised reflection of the objective properties, too, of the instruments of labour, which are crystallised in it, are thus also the product of social rather than individual practice. Even the simplest human knowledge that still comes about in a directly practical labour action, in an action by means of tools, is consequently not limited to man's personal experience, but comes about on the basis of the experience of social practice that he possesses.

Finally, human knowledge, which comes about originally in the process of instrumental labour activity, is capable of passing into genuine thought, unlike the instinctive intelligent activity of animals.

Thinking, in the proper sense of the word, we call the process of conscious reflection of reality in those of its objective properties, links, and relations that include as well objects not accessible to direct sense perception. Man does not, for example, perceive ultraviolet rays, but he nevertheless knows they exist and knows their properties. How is such knowledge possible? It is possible in an indirect way, and this way is the way of thought. In its most general principle it consists in our testing things by other things and, by recognising the relations and interactions established between them, judging their properties that are directly hidden from us from the change we perceive in them.

A *sine qua non* of the origin of thought is therefore the singling out and comprehending of objective interactions, i.e. the interactions of objects. But comprehension of these interactions is impossible within the limits of animals' instinctive activity. Once again it first comes about only in the labour process, in the process of using tools, by means of which men actively affect nature.

> But it is precisely *the alteration of nature by men*, not solely nature as such, which is the most essential and immediate basis of human thought (Engels said), and it is in the measure that man has learned to change nature that his intelligence has increased[36].

[36] Frederick Engels. *Op. cit.*, p 231.

Human thought differs radically in that from the intelligence of animals which, as special experiments have demonstrated, only implements adaptation to the actual conditions of the situation and cannot, except by chance, alter them, because their activity as a whole always remains aimed at some object of their biological need rather than at these conditions. It is different with man. Man's 'phase of preparation', from which his thought also grows, becomes the content of independent, purposeful acts and consequently can also become independent activity capable of being transformed into wholly internal, mental activity.

Thought, finally, like human knowledge in general, differs in principle from the intelligence of animals in that its origin and evolution are also possible solely in unity with the evolution of social consciousness. Not only are the goals of human intellectual activity social by nature, but its modes and means, as we have already seen, are also socially developed. Subsequently, when abstract speech thought arises, it also can come about only on the basis of man's mastering of socially developed generalisations, i.e. verbal concepts and logical operations, also socially developed.

The last point on which we must specially dwell is that of the form in which man's conscious reflection of the reality around him occurs.

The conscious image, notion, concept have a sensory basis, but conscious reflection of reality is not just sensory experience of it. Even simple perception of an object is reflection of it not only as possessing form, colour, etc. but at the same time having a certain objective, stable significance, as, for example, food, a tool, etc. There must consequently be a special form of the conscious reflection of reality that differs qualitatively from the directly sensory form of psychic reflection peculiar to animals.

What is this concrete form in which men's consciousness of the objective world around them really occurs? It is language, which is, in the words of Marx and Engels, men's 'practical, real consciousness'.[37] Consciousness is therefore inseparable from language. Language, like man's consciousness also, arises solely in the labour process, and together with it. Language, like consciousness, is a product of men's

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[37] Karl Marx and Frederick Engels. The German Ideology. *Op. cit.*, p 44.

activity, a product of the group; only therefore does it also exist for the individual person.

> Language is as old as consciousness, language *is* practical, real consciousness that exists for other men as well, and only therefore does it also exist for me.[38]

The origin of language can be understood only in relation to the need developing for people in the process of labour to say something to one another.

How then did speech and language take shape? People, as we have seen, necessarily enter into relations with one another in labour, into intercourse with one another. Originally their labour actions proper and their intercourse were a single process. Man's work movements, in acting on nature, also acted on the other participants in production, which meant that his actions acquired a dual function in these circumstances, viz. a directly production function and a function of affecting other people, a function of intercourse.

Subsequently these two functions became separated. For that to happen it was sufficient for people's experience to show them that even when a work movement did not lead to its practical result for some reason or other, it was still capable of affecting others involved in production, was able, for example, to draw them into joint fulfilment of a given action. Movements thus arose that preserved the form of the corresponding work movements but lacked practical contact with the object, and consequently also lacked the effort that converted them into real work movements. These movements, together with the vocal sounds that accompanied them, were separated from the tasks of acting on an object, and separated from labour activity, and preserved in themselves only the function of acting on people, the function of speech intercourse. In other words they were converted into gestures. A gesture is nothing else than a movement separated from its result, i.e. not applied to the object at which it is aimed.

At the same time the main role in intercourse was transferred from gestures to vocal sounds; vocal, articulated speech arose.

The content of some sort signified in speech was fixed, consolidated in language. But for a given phenomenon to be signified and reflected in language, it had to be singled

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[38] *Ibid.*

out consciously, and that, as we have seen, happened originally in men's practical activity, in production.

> Men began, in fact (Marx wrote), with their appropriating of some things of the external world as means suitable to satisfy their needs, etc. etc.; later they came to designate them *verbally as well* as what in practical experience they were for them, namely *means to satisfy their needs*, things that 'satisfied' them.[39]

The production of language, and of consciousness and thought, was originally directly interwoven in production activity, in men's material intercourse.

The direct connection of language and speech with men's labour activity was the chief and basic condition through which they were evolved as bearers of the 'objectified', conscious reflection of reality. By signifying an object in the labour process, a word singled it out and generalised it for the individual consciousness precisely in its objective, social relation, i.e. as a social object.

Language thus functions not only as a means of men's intercourse but also as a means or form of human consciousness and thought, also not yet separated from material production. It became the form, the vector of conscious generalisation of reality. That is why the abstraction of verbal meanings from the real object, which made their existence simply as facts of consciousness possible, i.e. simply as thoughts, simply ideally, happened at the same time as the subsequent separation of language and speech from directly practical activity.

In considering the conditions for the transition from the preconscious psyche of animals to the consciousness of man, we have found certain features that characterise the peculiarities of this higher form of psychic reflection.

We have seen that consciousness can only arise when man's relation to nature has become mediated by his labour connections with other men. Consciousness is precisely, consequently, 'from the very beginning a social product'.[40]

We have seen, furthermore, that consciousness became possible only in conditions of active influencing of nature,

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[39] Karl Marx. Randglossen zu Adolph Wagners 'Lehrbuch der politischen Ökonomie'. Marx/Engels. *Werke*, Vol, 19 (Dietz Verlag, Berlin, 1972), p 363.

[40] Karl Marx and Frederick Engels. The German Ideology. *Op. cit.*, p 44.

i.e. in conditions of labour activity by means of tools which is at the same time the practical form of human consciousness as well. Consciousness is consequently a form of active, comprehending reflection.

We have seen that consciousness is possible only given the existence of language, which arises simultaneously with it in the course of labour.

Finally, and we would specially stress this, man's individual consciousness is possible only given the existence of social consciousness. Consciousness is the reflection of reality refracted as it were through the prism of socially developed *linguistic* meanings or concepts.

These features, which characterise consciousness, are, however, only its most general and abstract ones. Man's consciousness then is the concrete, historical form of his psyche. It acquires various features depending on the social conditions of men's lives, becoming altered in the wake of the development of men's economic relations.

III. A Propos of the Historical Development of Consciousness

1. The Problem of the Psychology of Consciousness

Man's consciousness is not something immutable. Some of its features in any concrete historical circumstances are progressive, with prospects of development, others are survivals doomed to extinction, which means that consciousness, the psyche, needs to be regarded in its change and development, in its essential dependence on men's way of life which is determined by actual social relations and by the place a person occupies in them. It is thus necessary to approach the evolution of man's psyche as a process of qualitative changes, for if the social conditions themselves of men's being also develop by way of qualitative changes rather than simply through quantitative ones, it is clear that their psyche and consciousness also change qualitatively in the course of socio-historical development.

What do these qualitative changes consist in? Can it be that they consist only in the content that men perceive, feel, and think being altered? That view was stressed in the old psychology, for example by Wundt, who affirmed that the properties of the human psyche were always and everywhere the same, that only the content of men's experience and knowledge was altered. But that view has long been abandoned; it can be considered established that changes in the qualitative features of man's psyche are also observed in the course of evolution.

These changes cannot be reduced to changes in individual psychic processes and functions, although most writers maintain that the historical evolution of man's psyche consists precisely in the reconstructing of separate processes (perception, memory, and especially thought and speech) and finally in their role changing so that now some and then other psychic processes play the main role (Levy-Bruhl, Thurnwald, Danzel).

It has now been shown that individual psychic processes are actually reorganised during historical development. It is known, for instance, that the memory of the people of certain economically and culturally backward nationalities has very unique features, e.g. a capacity to fix the features of a locality with amazing accuracy (so-called topographic memory). We know that the thinking of these people is also extremely original, and it seems even to have a special logic.

When, however, we confine ourselves to study only of those separate psychic processes, we cannot bring out the real history of the evolution of the human psyche. People living in different historical epochs and in different social conditions of course also differ in what are their processes of perception, memory, thought, etc. But does the difference between these processes exhaust the difference between their psyche and their consciousness? We assume that it does not, that changes also take place in the course of historical development in the general character of men's consciousness that are engendered by changes in their mode of life.

We have seen that the general type of psychic reflection changes with the transition to man, and that a new, higher type of psyche—consciousness—arises.

We have seen that the transition to this higher type of psyche comes about as a consequence of the emergence of men's production relations. The features of men's psyche

are also determined by the features of these relations and depend on them. We know at the same time that production relations alter, that the production relations of primitive society are one thing and those, for example, of capitalist society are quite another matter. It can be taken, therefore, that with a radical change in men's production relations their consciousness is also altered in a radical way and becomes qualitatively different. The task is to find the concrete psychological features of these different types of consciousness.

To solve this problem, however, calls for a quite different approach to consciousness than that rooted in the traditions of bourgeois psychology.

In passing off class man's consciousness as eternal and universal, capitalist psychology depicts it as something absolute—unqualified and 'indefinite'. It is a special psychic space ('scene', according to Jaspers); it is, consequently, only a condition of psychology, not its subject matter (Natorp). For Wundt consciousness consisted simply in any psychic state whatsoever found in general within ourselves.

Consciousness from that point of view is psychologically a kind of inner 'luminescence' or 'glow', that is bright or clouded, or even extinguished, as for example in a deep faint (Ladd). It can therefore have only purely formal properties; they are also expressed by its so-called psychological laws (the unity, continuity, and narrowness of consciousness, etc.).

Things are also not altered in principle when consciousness is regarded as the 'psychic subject', or as James put it, the 'boss' of the psychic function. This mystification of the real subject through its identification with consciousness in no way makes the latter psychologically more meaningful; it proves ultimately that consciousness, too, like the subject, is also 'metapsychic', i.e. goes beyond the limits studied by psychology.

From the standpoint of the traditional bourgeois psychological approach to consciousness only what 'is found' in consciousness, or 'belongs' to it, is subject to study, i.e. separate psychological phenomena and processes and their mutual relations and connections.

In fact psychological study of consciousness mainly took the line of studying thought. As a result, when speaking of

consciousness they began precisely to have thought in mind, the round of notions or ideas, and concepts. That is proper when it is a matter of studying the evolution of human understanding but psychologically the evolution of consciousness does not boil down to the evolution of thought. Consciousness has its own substantial psychological character.

In order to find this psychological character of consciousness we have to discard the metaphysical notions that isolate it from real life. We must, on the contrary, investigate the dependence of man's consciousness on his mode of life, on his being. And that means that it is necessary to examine how man's life relationships are built up in any set of socio-historical conditions and what is the special structure of the activity that those relations give rise to. It is necessary, furthermore, to examine how the inner structure of man's consciousness also changes at the same time as the structure of his activity. The characteristics of the inner structure of consciousness are also its psychological ones.

We have already tried to show that a certain type of psychic reflection corresponds to a certain type of structure of activity. That dependence is also retained subsequently, in the stages of the evolution of human consciousness. The main difficulty in research here is to find the actual 'generatrices' of consciousness, its real inner relations that are not only hidden from our self-observation but are now and then contradicted by what the latter discloses.

In order to prepare to analyse the main changes in consciousness that take place during the development of human society, we have to dwell first of all on certain general features proper to its developed structure.

We have already noted that the main change in the form of psychic reflection that occurs during the transition to man is that reality is discovered to him in the objective stability of its properties, in its separateness and independence from his subjective attitude to it, and from his real needs, or, as it is put, is 'presented' to him. This 'presentationism' properly consists in being aware, in the conversion of unconscious psychic reflection into conscious reflection. Let us take an example to clarify what we mean by that.

Suppose a person is walking along the street deep in conversation with his companion. In normal cases all his behaviour would ultimately be in full accordance with what

is going on around him; he slows his pace at crossings, avoids on-coming pedestrians, steps off the pavement onto the roadway and back again, and so on. Obviously he is perceiving his environment. Has he, however, a conscious image of the situation in the street? If he is very deep in conversation, he may very well not. In that case we can say that the situation in the street is not 'presented' to him at that moment. But now he is clearly conscious that before him is the house where he is going with his companion. A picture of the street opens up before him now, as it were, and is 'presented' to him.

This example undoubtedly depicts a psychological phenomenon that is only analogous to the fact that we are examining. All the same it can show in what sense we are employing the term 'presentation'.

Thus reality is presented to man in consciousness. How is that fact possible psychologically?

Any psychic reflection is the result of a real connection, of a real interaction of a living, highly organised, material subject and the material reality around him. The organs of psychic reflection themselves are at the same time organs of this interaction, organs of vital activity.

Psychic reflection cannot arise without life, without the subject's activity. It cannot help depending on activity, cannot help being subordinated to the subject's life relations realised by activity, cannot help being partial, since these relations themselves are partial.

In other words psychic reflection inevitably depends on the subject's relations with the reflected object, i.e. on its *vital* meaning for the subject. That remains correct also as regards man, but with the transition to human consciousness something new also develops. An animal, on experiencing a need for food, is stimulated by that influence that is stably associated with food; this influence in fact only acquires the force of a food stimulus for it. With man it is otherwise.

When a primitive beater raises game—and that is the direct objective of his action—he is conscious of this goal, that is to say it is reflected for him in its *significance* in objective (in this case direct labour) relations.

The meaning or significance is also that which is objectively revealed in an object or phenomenon, i.e. in a system of objective associations, relations, and interactions. The

significance is reflected and fixed in language, and acquires stability through that. In this form, in the form of linguistic meaning, it constitutes the content of social consciousness; by entering into the content of social consciousness it also becomes the 'real consciousness' of individuals, objectifying in itself the subjective sense of the thing reflected for them.

Conscious reflection is thus psychologically characterised by the existence of a specific internal relation, namely the relation between the subjective sense and meaning.

This relation is very important and we shall therefore have to dwell on it specially. Since the concept of meaning or significance is more developed in modern psychology, we shall begin by examining it in particular.

Meaning is the generalisation of reality that is crystallised and fixed in its sensuous vehicle, i.e. normally in a word or a word combination. This is the ideal, mental form of the crystallisation of mankind's social experience and social practice. The range of a given society's ideas, science, and language exists as a system of corresponding meanings. Meaning thus belongs primarily to the world of objective, historical phenomena. And that must be our starting point.

Meaning, however, also exists as a fact of the individual consciousness. Man perceives the world and thinks about it as a social, historical entity; he is armed and at the same time limited by the ideas and knowledge of his time and his society. The wealth of his consciousness is in no way reducible to the wealth of his personal experience. Man does not know the world like a Robinson Crusoe making independent discoveries on an uninhabited island. He assimilates the experience of preceding generations of people in the course of his life; that happens precisely in the form of his mastering of meanings and to the extent that he assimilates them. Meaning is thus the form in which the individual man assimilates generalised and reflected human experience.

As a fact of individual consciousness meaning does not, however, lose its objective content and does not become a purely 'psychological' thing. What I think, understand, and know about a triangle may of course not coincide exactly with the meaning of 'triangle' accepted in modern geometry. But that is not a fundamental contrast. Meaning has no existence except in concrete human heads; there is no inde-

pendent realm of meanings, like Plato's world of ideas. It is consequently impossible to counterpose this meaning in the consciousness of the individual to 'geometric', logical, or objective meaning in general as a special psychological meaning; the distinction here is not between the logical and the psychological, but rather between the general and the isolated, the individual. Can 'anybody's' concept really exist?

The main psychological problem about meaning is the question of what is its real place and role in man's psychic life, what they are in his life.

Reality is revealed to man in meaning, but in a special way. Meaning mediates man's reflection of the world inasmuch as he is aware of it, i.e. inasmuch as his reflection of the world is based on the experience of social practice and includes that.

A sheet of paper is reflected in my consciousness not only as something rectangular, white, and covered with lines and not only as a certain structure and a certain integrated form, but also precisely as a sheet of paper, as *paper*. The sense impressions I receive from it are refracted in my consciousness in a definite way because I have assimilated the corresponding meanings; otherwise the sheet of paper would just remain something white, rectangular, etc., for me. But when I perceive paper—and this is very important in principle—I perceive this real paper, and not the meaning 'paper'. As a rule meaning is introspectively missing in my consciousness; in refracting the perceivable or the conceivable, meaning is not itself thereby recognised or thought about. That is a fundamental psychological fact.[41]

Psychologically, meaning is thus the general reflection of reality developed by humanity and fixed in the form of a concept or knowledge, or even in the form of an ability or skill as a generalised 'mode of action', norm of behaviour, etc., that has become accessible to my consciousness (more or less fully and many-sidedly).

Meaning is the reflection of reality irrespective of

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[41] It is another matter that meaning *can* be comprehended, but that is a secondary phenomenon that arises only when the object of consciousness is not the thing signified but the meaning itself, as happens, for example, in study of a language.

man's individual, personal relation to it. Man finds an already prepared, historically formed system of meanings and assimilates it just as he masters a tool, the material prototype of meaning. The psychological fact proper, the fact of my life, is this, (a) that I do or do not assimilate a given meaning, do or do not master it, and (b) what it becomes for me and for my personality in so far as I assimilate it; and that depends on what subjective, personal sense it has for me.

The concept of sense has been developed in bourgeois psychology in very different directions. Müller called it an embryonic image; Binet was much shrewder in calling it an embryonic action. Van der Veldt tried to demonstrate the formation of meaning experimentally as the result of a previously undifferentiated signal's acquiring for the subject the meaning of an action conditionally associated with it. Most contemporary writers, however, have taken another line, considering the concept of sense only in connection with language. Poland difined sense as the aggregate of all the psychic phenomena, evoked in consciousness by a word, Titchener as complex, contextual meaning, and Bartlett more exactly as the meaning created by the 'wholeness' of a situation, and many others as the concretisation of meaning, as the product of denoting.

For all this difference in understanding sense, there is also something in common in these writers, and that is that they treat phenomena belonging to the sphere of consciousness itself identically as the initial phenomena for analysis, and therefore remain identically locked within this sphere. But consciousness cannot be understood from itself.

Another approach in principle is that of genetic, historical research. This is an approach from the angle of analysing phenomena belonging not to consciousness but to life itself, i. e. from the aspect of phenomena that characterise the real interaction of a real subject with the world around him, in all the objectiveness and independence of its properties, connections, and relations. And sense therefore appears to a historical investigation of consciousness primarily as a relation that is created in life, in the subject's activity.

Arising in the course of the development of activity, in practice linking animal organisms with their environment, this specific relation is originally biological, and animals' psychic reflection of the external medium is inseparable

from this relation. Subsequently, for the first time only in man, this relation is differentiated for the subject as his relation and comprehended. This conscious sense is created concretely psychologically by an objective relation reflected in man's head of what stimulates him to act to what his action is directed as its direct result. In other words conscious sense expresses the relation of motive to goal. It is necessary simply to stress specially that we use 'motive' not to signify the experiencing of a need but as signifying the objective thing in which this need is concretised in the conditions and to which the activity is directed.

Suppose a student reads the literature recommended to him. That is a conscious, purposive process. Its conscious aim is to assimilate the content of this literature. But what personal sense does this aim, and so the corresponding activity, have for the student? That depends on what the motive is that stimulates the activity realised by his action. If it consists in preparing him for his future profession, the reading will have one sense for him, but if it is simply, for example, to pass an examination, then the sense of the reading will understandably be quite another one, and he will read the literature with other eyes, and assimilate it in a different way.

The question of personal sense can thus be answered by bringing out the corresponding motive.

Sense is always the sense of something. There are no 'pure' senses. Subjectively sense therefore belongs, as it were, to the comprehended content itself, and seems to be part of its objective content. That circumstance has also created very great misunderstanding in psychology and psychologising linguistics, which is expressed either in complete indistinguishableness of these concepts, or in sense being considered a concretised meaning, depending on the context or situation. In fact, although sense ('personal sense') and meaning introspectively seem merged in consciousness, the two concepts need to be differentiated from one another. They are linked internally with one another but only by a relation that is the reverse of the above-mentioned one; or rather, sense is expressed in meanings (like motive in aims), but not meaning in senses.

In some cases the disparity between sense and meaning in consciousness comes out especially clearly. One may know some historical event or another very well and excellently

understand the significance of some historical date, but that date may at the same time have a different sense for one: one sense, for example, for a youth who has not yet left school, another for the same youth when he is defending his country, and giving his life for it, on the battlefield. Has his knowledge of this event, of this historical date, been altered or increased? No, it has perhaps even become less distinct, something perhaps even forgotten; for some reason, however, it is now recalled and brought to mind, and then it proves to be illuminated in his consciousness, as it were, by some already quite different light, and brought out, as it were, in a fuller content. It has become different, but not as meaning, and not from the angle of *knowledge* of it, but from the aspect of its *sense for the individual*; it has acquired a new, deeper sense for him. Such changes had already been noted by Ushinsky.

In introducing a differentiation between personal sense and meaning proper into the psychological description of consciousness we must stress that this differentiation does not relate to the whole content but only to that to which the subject's activity is directed, for personal sense expresses precisely his *attitude* to comprehended objective phenomena.

We have dwelt in detail on the question of meaning and sense because their relation is that of the main 'generatrices' of the inner structure of human consciousness; it does not follow from that, however, that while being the main ones they are the only ones. Even while simplifying and schematising the very complex relations that are inherent in developed consciousness, we may yet, for all that, digress from one of its 'generatrices', namely from its sense content.

It is sense content (sensations, feelings, images of perception, representations) that forms the basis and condition of any consciousness. It is its material tissue, as it were, that which forms the richness and fullness of conscious reflection of the world. At the same time this content is what is direct in consciousness, what is directly created by the conversion of the energy of external stimulation into a fact of consciousness. But, while being the basis and condition of any consciousness, it is its 'generatrix' precisely because it does not, in itself, express everything specific in it.

Suppose a person suddenly loses his sight. The world would then be dimmed in his consciousness, but would

his consciousness of the world be altered? No, his consciousness of the world would, of course, be retained. It is another matter when a person's higher brain processes are disturbed. It is then precisely his consciousness itself that is drastically altered, although all his possibilities of direct sense perception of the world remain intact. That is well known.

Just as obvious is the statement that a change and development of the directly sensuous content of consciousness only happen in the course of the evolution of human forms of activity. The evolution of phonematic hearing in man comes about by men's employment of audible speech, while man's eye begins to see differently than the crude, non-human eye only inasmuch as the object becomes a *social* object for him.

The last question, finally, on which we shall have to dwell briefly is that of the general method of psychological research into the evolution of consciousness.

The evolution of consciousness, we know, does not have its own independent history, and is ultimately governed by the evolution of being. This general proposition of Marxism retains its force, it goes without saying, in respect of the development of individual consciousness and the consciousness of individual people.

What is the concrete link between the psychological features of man's individual consciousness and his social being? How, in other words, do we pass in research from analysis of the social conditions of the life of society to that of man's individual consciousness? And is it possible in general to make such a transition?

The answer to that stems from the basic psychological fact that the structure of man's consciousness is linked in a regular way with the structure of his activity.

Man's activity then can only have a structure that is created by given social conditions and the relations between people engendered by them. It is necessary, however, to stress here that, in speaking of the individual person's consciousness, we must bear in mind precisely those concrete conditions and relations in which this man is placed by the force of circumstances and that this connection is never at all direct.

Our general method thus consists in finding the structure of men's activity that is engendered by given concrete, his-

torical conditions, and starting from that structure to bring out the essential psychological features of the structure of their consciousness.

2. Primitive Consciousness

In bourgeois psychological literature a very broad, not quite definite meaning is illegitimately attached to the concept of primitive consciousness (more often termed thought). Any consciousness is called primitive that differs from the consciousness of men belonging to so-called civilised society (Lévy-Bruhl and others). A false counterposing of two types of psyche is thus created at bottom, namely between a 'lower' and a 'higher' psyche, a counterposing based on reactionary, colonialist 'doctrines' about the alleged psychic inferiority of whole peoples.

When we speak of primitive consciousness we have something else in mind, namely man's consciousness in the initial stages of society's development when, already possessing primitive tools, they waged a joint struggle against nature, when they had common labour, common ownership of the means of production, and common ownership of its product, when, consequently, there was, as yet, no social division of labour and private property relations, and no exploitation of man by man. In short we have in mind the consciousness of men in the early stages of the evolution of the primitive communal system.

What is it that characterises the structure of man's consciousness psychologically at those early historical stages?

Its characteristics stem from the main features inherent in man's activity in those conditions. The first of these features is that the new structure of activity, social by nature, did not originally embrace all its forms.

The range of the conscious was limited simply to the individual's relations that were directly relations of the process of material production. As Marx and Engels said:

> The production of ideas, of conceptions, of consciousness, is at first directly interwoven with the material activity and the material intercourse of men.[42]

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[42] Karl Marx and Frederick Engels. The German Ideology. *Op. cit.*, p 36.

The sphere of sex relations, for example, is therefore not represented at all in primitive linguistic meanings; clear evidence of that is the fact that all sex terms were originally asexual. For that same reason the names of domestic animals appeared before those of wild ones; the same also applies to plants.

In other words the sphere of linguistic meanings already coexisted at the dawn of man's evolution with a much wider sphere of instinctive, biological senses, in the same way as men's still numerous instinctive relations with nature coexisted along with their socially mediated relations with it. That is the first point.

Another feature characterising consciousness at that very early time in its evolution is that it was not yet fully such even within the narrow limits of the conscious.

The evolution of consciousness thus did not take place at all as if a previously dark inner field of perception were suddenly evenly illuminated by 'the light of consciousness', at first dimly, hardly flickering, and then getting stronger, which made it possible to distinguish the content composing it more and more correctly and exactly. The conscious was originally tightly limited.

Finally, we find a feature of primitive consciousness that defines its general structure, its general formation as it were, which lasted for the whole existence of the primitive commune.

Originally men were not at all conscious of their relations with the group. Only the beginning of a consciousness that man lived in general in society had developed. As Marx and Engels put it:

> This beginning is as animal as social life at this stage. It is mere herd-consciousness, and at this point man is distinguished from sheep only by the fact that with him consciousness takes the place of instinct or that his instinct is a conscious one.[43]

At later stages, when men's consciousness, as we shall see, made important steps in its evolution, linguistic meanings, formed in men's joint labour activity, already reflected their relations with one another as well as with nature. But because the relations of the individual participants in collective work with the conditions and means of production remained in general the same, the world was reflected

[43] *Ibid.*, p 44.

in the same way both in the system of linguistic meanings that formed the group's consciousness and in the consciousness of the separate individuals—in the form of these same meanings.

This is connected psychologically with this, that the sense of the phenomenon that the separate individual is aware of and its sense for the group as a whole, fixed in linguistic meanings, coincide. This undifferentiated character of senses and meanings in consciousness is possible because the range of the conscious still remains limited for a long time by those of men's relations that are directly the relations of the whole group, and on the other hand because the linguistic meanings themselves are not sufficiently differentiated.

The coincidence of senses and meanings is the main feature of primitive consciousness. Although the breakdown of this coincidence is prepared already within the primitive communal system, it takes place only together with the breakdown of the system itself.

The condition that prepared the differentiation of senses and meanings was, from the angle of the evolution of consciousness itself, the extension of the range of the conscious to which the development of labour necessarily led, i. e. of its tools and forms, and the work relations of those involved in production.

The first important change in the direction of an extension of the realm of the conscious was caused by the complicating of work operations and of the tools themselves. Production more and more called for a whole system of coordinated actions from each participant in the work, and consequently for a whole system of conscious aims, which at the same time were parts of a single process and of a single, complex action. Psychologically this merging of separate, partial actions into a single action was a conversion of partial actions into operations. The content that had previously occupied the structural place of conscious *aims* or *objectives* of these partial actions thus occupied the place in the structure of the complex action of the conditions for its fulfilment. And that means, that now both the operations and the conditions of an action could also enter the realm of the conscious. Only they did so in an essentially different way than the actions proper and their goals.

This metamorphosis of actions, i. e. their conversion into operations and so the consequent birth of operations

of a new type (we shall call them conscious operations), has been well studied experimentally, but in modern conditions, it goes without saying. It is therefore easily described.

When, for example, a learner hits the target in shooting practice, he performs a definite action. What characterises it? First of all, of course, what the activity is that it forms part of, i. e. what its motive is, and consequently what sense it has for him. But it is also characterised by something else, namely by the means and operations by which it is performed. The aiming of the shot calls for many operations, each one corresponding to certain conditions of the action: it is necessary to put the body in a certain position, to align the sights of the rifle and correctly establish the line of sight, to press the butt to the shoulder, to hold the breath, and to press the trigger smoothly.

For the trained marksman none of these processes is an independent action, and their objectives are not singled out in his consciousness. He does not say to himself: 'Now I must cradle the butt; now I must hold my breath', and so on. There is only one aim, to hit the target; and that means that he has command of the motor operations necessary for shooting.

It is different with the person who is only beginning to learn to shoot. First he must make it his objective to hold the rifle correctly, and his action consists in that; then he makes the aiming his conscious action, and so on. Thus, in tracing the process of learning to shoot, or incidentally of the learning of any complex action, we see that the elements composing it are first formed as separate acts and only then converted into operations.

These operations, however, differ from those that arise through the simple adaptation of an action to the conditions of its performance. As experimental research has demonstrated, these operations are above all distinguished objectively by their flexibility and controlled nature. They also differ by quite another relation to consciousness.

An action, and its objective composing part of another action, are no longer 'presented' directly in consciousness. That does not mean, however, that they cease to be conscious. They simply occupy a different place in consciousness; they are only consciously controlled, as it were, i. e. *can* be conscious in certain conditions. Thus the operation

of aligning the foresight like its position itself in relation to the backsight, may not be presented in the consciousness of an experienced shot, but it is sufficient for there to be some departure from its normal performance for the operation itself, like its material conditions, to come distinctly then into his consciousness.

These transformations of unconscious content in conscious and vice versa, that occur in connection with a change of the place occupied by the content in the structure of the activity, can now also be understood neurophysiologically.

Modern research has shown that any activity is physiologically a dynamic functional system controlled by complex, varied signals coming both from the environment and the organism itself. These signals arriving at various interconnected nerve centres, including proprioceptors, are synthesised. Involvement of nerve centres is also characteristic of the structure of activity as regards its neurological aspect. Activity may proceed at various stages of the nervous system, involving its various 'levels'. These levels, however, are not equal. One of them is the leading one, while the others play the role of background ('background levels' in Bernstein's terminology[44]). It is notable, here, that (as Bernstein specially stresses), the sensory signals of the highest, leading level are always conscious. This conscious content also controls activity, whose structure may be different. Its leading level itself is determined by what Bernstein called the task, i. e. by exactly that which has to be called objective in our terminology (we mean something else by task, namely the goal or objective set in certain conditions).

Although the relations described above are established for fully developed consciousness, they permit us also to understand the historical origin of the possibility of being aware not only of the content occupying the structural place of a goal in activity but also the modes of activity and the conditions in which they take place.

The need for awareness of operations already arose in the transition to the fashioning of differentiated tools, and especially of composite ones. The earliest tools, as archaeological finds have shown, could still have been the result

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[44] See: N. A. Bernstein. *O postroenii dvizheniya* (A Propos the Structuring of Movements), Moscow, 1947.

of simple 'adaptation' of natural objects to the conditions of labour activity (for example, the 'natural retouching' of universal stone implements in the course of using them).

It is another matter with the production of specialised tools. Their fashioning necessarily calls for differentiation and awareness of operations, for the production of such tools has as its aim precisely the operation that is objectivised in it.

Labour operations that were originally formed in the course of simple adaptation to existing external conditions thus acquire another genesis in connection with their complication: when the goal of the action is part of another action as a condition of its performance, the first action is transformed into a mode of realising the second, into a conscious operation. That also greatly extends the sphere of the conscious. The whole significance of that for the subsequent evolution of human activity will be readily understood.

From the aspect of the structure of man's consciousness the formation of conscious operations means a new step in its development, a step that consists in the rise of a 'consciously controlled' content in addition to the content presented in consciousness. and the transition of the one to the other.

In order to avoid misunderstanding here, we must note simply that the relation of consciousness described above is also preserved, as we have seen, in its developed forms, but is not grasped immediately by introspection. When a person is reading, for example, it seems to him that both the ideas expressed in the book and the outward graphic form of their expression, i.e. the text itself, are recognised identically—both the one and the other. In fact, however, that is not wholly so; in fact only the ideas and their expression are presented in consciousness, and the outward aspect of the text may only *seem* to be conscious, as it usually is when there are omissions, crude typographical errors, etc. But if the reader asks himself whether he is also conscious of the outward aspect of the text and so shifts the aim from the content of the text to that very aspect of it, he is, of course, clearly aware of it. That kind of unnoticed conversion of operations into action—in our example the conversion of perception of the text as an operation of reading into perception of it as an independent, purposive inner

activity—also creates an illusion of the 'field' of consciousness being structureless.

Extension of the realm of consciousness through the inclusion of the material conditions, means and modes of an action in it does not exhaust the process.

There is yet another essential change in activity that leads to awareness of the sphere of men's other relations coming about as well as awareness of the sphere of direct production.

The emergence of a relatively stable technical division of labour made this change necessary; the division was expressed in individual people's acquiring of fixed production functions, i.e. in their being constantly engaged in performing a certain round of actions. The natural consequence of that (once again already described in the old psychology) was that a kind of shift of motive took place in the objective of these actions. The action was also now transformed, but no longer into an operation, as we saw above, but into activity that now has an independent motive. Because of that motives also come into the realm of the conscious.

Such shifts of motives are constantly observed at the highest stages of development as well. These are the ordinary cases when a person undertakes to perform some actions under the influence of a certain motive, and then performs them for their own sake because the motive seems to have been displaced to their objective. And that means that the actions are transformed into activity. Motives of activity that have such an origin are conscious motives. They do not become conscious, however, of themselves, automatically. It requires a certain, special activity, some special act. This is an act of reflecting the relation of the motive of a given, concrete activity to the motive of a wider activity, that realises a broader, more general life relation that includes the given, concrete activity.

While arising originally as an actually occurring shift of motives to conscious aims, the process of becoming aware of motives then becomes a sort of general mechanism of consciousness. The motives that correspond to primary biological relations can therefore also become conscious and can enter the realm of the conscious.

That fact has a dual significance.

(1) It makes it psychologically understandable how reflection of the sphere of other human relations can become

conscious at a certain stage of socio-historical evolution, as well as reflection of the sphere of directly material production.

At the dawn of the evolution of society, for example, men's sexual relations, not yet limited by anything, lay in the sphere of purely instinctive relations, but the gradual contraction of the range of possible relations of marital community between the sexes that began indicates that these relations were then coming into the sphere of conscious relations. The fact that some of them became taboo already suggests the possibility that relations of kinship had become conscious.

(2) The fact of a shift of motives to the goals of actions makes it psychologically understandable how new needs could arise and the very type of their development become altered.

A need of some sort is a prerequisite of any activity. In itself a need cannot, however, determine the concrete direction of activity. A need gets its definiteness only in the object of the activity; it has as it were to find itself in it. In so far as a need finds its definiteness in an object (becomes 'objectified' in it), the object becomes the motive of the activity, and that which stimulates it.

In animals' activity the range of possible motives is strictly limited to actual natural objects corresponding to their biological needs, and any step in the development of the needs themselves is caused by a change in their physical organisation.

It is another matter in the conditions of men's social production of objects serving as means of satisfying their needs. As Marx and Engels said, production furnishes not only the material for a need but also the need for material.[45]

What, however, does it mean psychologically? In itself the fact of the satisfaction of a need by means of new objects—means of consumption—can lead only to this, that the objects acquire a corresponding biological sense and perception of them will subsequently stimulate activity directed to getting them. We are concerned with the *production* of objects that serve as means to satisfy a need. And for that it is necessary for consumption—whatever the form it

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[45] See: Karl Marx and Frederick Engels. The German Ideology. *Op. cit.*, pp 42. 82.

takes—to lead to reflection of the means of consumption as what must be produced. Psychologically that means that the objects—the means of satisfying needs—must be recognised as motives, i.e. must enter consciousness as an inner image, as a need, as stimulation, and as objective.

The link between consciousness of motives and the development of needs is not exhausted, of course, by the fact of consciousness of motives corresponding to natural needs. The decisive psychological fact consists in the shift of motives precisely to those objectives of action that do not directly meet natural, biological needs. Such, for example, are the cognitive motives that subsequently arise. Knowledge, as the conscious aim of an action, can also be stimulated by a motive that meets a natural need for something. The conversion of this objective into a motive is also the birth of a new need, in our example a thirst for knowledge.

The creation of new, higher motives and the formation of new, specific, human needs corresponding to them are a very complicated process, which also takes place in the form of a shift of motives to objectives and their recognition.

Thus, already in the conditions of primitive society, the evolution of material production and of the mutual relations between people built up during it created a need for full extension of the realm of the conscious. As more and more aspects and relations of human affairs begin to be determined socially, i.e. become social in their nature, consciousness more and more acquires the character of the universal form of man's psychic reflection of reality. That does not, of course, mean that all reality now forms part of the realm of the conscious; it only means that everything *can* enter this sphere.

We have not the space to trace out the concrete dependencies that link together the successive stages of the broadening of the sphere of the conscious with the historical stages of the evolution of primitive society. That calls for extensive special research. We can only note that the facts which characterise the level of development of production, of men's mutual relations and their language, are undoubtedly evidence that the process of broadening the sphere of the conscious was already completed at the level of the primitive communal system.

The stages in the extension of the realm of the conscious described above only express the evolution of consciousness

from its functional aspect, from the aspect of the development of the process of comprehension. These stages, in forming layers on each other, as it were, also form the functional structure of consciousness, which is characterised by the process of comprehending the content, which occupies a different place in the structure of activity, taking place in a psychologically different concrete form.

Thus the content that occupies the structural place of objective in an action, is always presented, i.e. is always actually realised. The content that forms part of the structure of activity as the action's conditions and as the operations meeting these conditions is realised differently, as we have seen. Finally the motives of the activity are realised differently still. Consciousness thus by no means appears to us, even from this functional and descriptive aspect of it, as an unqualified, uniform 'psychic space' limited only by its 'volume' and the brightness of its 'glow', but does so as characterised by definite relationships and a historically moulded structure. The forming of this functional structure of consciousness also constitutes the main content of the evolution of man's consciousness, which takes place within the limits of its general, primitive type.

This general type of consciousness is characterised, as we have already said, by a coincidence of meanings and senses. This coincidence is originally the psychological expression of the sameness of men's relation to the instruments and products of labour, i.e. to the first objects that enter the realm of the conscious.

The development of the means and relations of production, however, and the extension of the sphere of cognised phenomena taking place on that basis had inevitably to lead to a divergence between how these phenomena are reflected in the heads of individual people and how they are generalised in linguistic meanings, only in the form of which they can be comprehended. In the epoch of primitive society this divergence is expressed in a person's sense of the phenomena of reality being comprehended within a limited round of meanings. The latter, on the other hand, acquire a capacity to migrate from one group of the phenomena of reality, which they reflect, to the phenomena of another group.

The many facts that constitute the factual aspect of Lévy-Bruhl's well-known conception are evidence of this

divergence, which survives vestigially in certain conditions for a long time still after the breakup of the primitive commune. But this same divergence at the same time provides the key to a correct understanding of the phenomena that he describes as 'prelogical'.

Lévy-Bruhl points out, for example, that the men of the Huichol tribe identify deer and feathers, wheat and deer, etc. among themselves. This seems also to characterise their thinking, i.e. the way these things are represented in it.

This generic, i.e. generalised, image, he writes, 'implies something quite different from the quite similar image that comes to the mind of a European in the same circumstances.[46] But that, of course, is impossible. It is impossible for their thinking to be really such. Their thought is not characterised just by a 'logic of implication' that merges wheat and deer in a single, generalised image, but primarily by the fact that they rationally sow fields of wheat and with full consciousness of the object of their actions hunt deer. In practice they act quite differently in regard to the one and the other: quite different images of these objects have also obviously been created among them, and they are by no means merged with one another in their thinking when they cultivate plants or pursue game, as has been pointed out many times by Lévy-Bruhl's critics.

It is another matter what is the form in which the sense of what is presented enters their consciousness, i.e. what are the linguistic means that still objectify in themselves the reflection in consciousness of the given objects from the aspect of the group's relation to them. For from the aspect of these relations deer and wheat really have something in common, which is that they are identically objects on which the tribe's existence depends.

Wheat, the Huichol say, was once a deer. In a special ceremony they place a deer on wheat, treating it as if it were a sheaf of the latter. In the view of Lumholtz and Lévy-Bruhl this happens because wheat is a deer in the notions of the Indians.

If we start from the point that the structure of primitive consciousness and of the consciousness of modern man is

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[46] L. Lévy-Bruhl. *Les fonctions mentales dans les sociétés inférieures* (Alcan, Paris, 1922), p 136.

the same, then such an assumption is understandable, although it also leads to a flagrant contradiction with the facts of the practical life of the men of this tribe. If, on the contrary, we start from the point that primitive consciousness has a quite different internal structure than ours, which is that it is characterised still by an indifference of senses and meanings, then the phenomena described take on a quite different aspect.

The resemblance of the meanings 'deer' and 'wheat' is obviously, from this point of view, only the form of comprehending the carrying over of their sense, i.e. the transfer of the group's practical relations from deer to wheat. This transfer, which reflects the transition from a predominance of hunting and herding to a predominance of plant growing (which leads to an important change of mutual relations within society—which is now already tribal), is also consolidated ideologically in the ceremony described.

We find the same in other cases as well. The even more puzzling implication of the meanings 'deer' and 'feather', for example, expressed only awareness of the fact that an arrow has to be so fashioned as to be able to hit a deer. The fact of the binding of deer hairs to the feathering of an arrow that directs its flight is evidence of that.

Among the peoples of Bantu tribes barren wives are recognised as a calamity. Lévy-Bruhl explains that by their thinking identifying barren women and crop-failure. We must, however, reject the preconceived idea that consciousness is determined by thinking and knowledge. Then, behind this 'implication of representations' or this 'ignorance', something quite different is revealed, and that is the peculiar form of expression of the identity of the social sense (meaning) of the one and other in consciousness: smallness of a family leads to a lack of grain in the household, the same as a crop-failure.

The many facts of the 'mystic implication' of the properties of objects and men's actions or relations are particularly noteworthy. In the conditions of the commencing development of a social division of labour and private property, objects actually acquire 'ultrasensory' properties for man that depend not on the things themselves and not on their natural character, but on the men's relations moulded in production. It is these relations that also determine how an object really appears for man. If awareness of this,

however, acquires special forms quite different from ours, that once again does not depend on a 'mysticalness' of thinking but is determined by the fact that in the epoch when men's social relations are already objectively differentiated, their consciousness continues to preserve its earlier structure and earlier type of awareness through direct embodiment of the sense cognised in socially developed meanings.

The general picture presented by the forms of consciousness described is specially complicated by the difficulty of separating psychological, proper linguistic, and purely ideological formations from one another. To analyse this picture we need above all, of course, to make a careful study of the connections of the phenomena that characterise consciousness with the concrete, socio-economic conditions that give rise to them. But in modern, so-called ethnopsychology, this has not been adequately done, so that the concept of primitive consciousness remains extremely vague in it, as we have already noted.

We have not set ourselves the task of tracing the course of the historical evolution of consciousness in this essay. We therefore limit ourselves, as regards the early forms of consciousness, to the general description given above of its most primitive structure.

The primitive structure of consciousness with progressive development was already breaking down in tribal society, but its new internal structure only found full expression in the later stages of class society. We shall now try to describe its main features in precisely those stages.

3. Men's Consciousness in Class Society

We saw above the simplest inner structure of man's consciousness, which reflects his relation to nature and to other men under the primitive communal system. It is characterised by the sense of the phenomena of reality still coinciding directly for man with the meanings socially developed and fixed in language, in whose form these phenomena are comprehended. Common property put men into identical relations with the means and products of production, and they were reflected identically in the consciousness both of the individual and of the group. The product of common labour

had a common sense, for example, of 'good' or the 'commonweal', both objectively, socially, in the life of the community, and subjectively for any of its members. Socially developed linguistic meanings, crystallising the objective social sense of phenomena, could therefore serve as the direct form of the individual consciousness of these phenomena as well.

The breakdown of this—we might call it the primitive, integrated—formation of consciousness had already been prepared within primitive society. As we have already remarked it was prepared (if we bear in mind the changes taking place in a reflected way in consciousness) by a broadening of the range of conscious phenomena and the disparity arising, as a consequence, between the wealth of the conscious and the relative poverty of the language, which sometimes led to an inadequate *psychological* differentiation of meanings.

Only the emergence and development of a social division of labour, however, and of private property relations, could lead to the old structure of consciousness giving way to a new structure corresponding to the new socio-economic conditions of men's life.

This new structure of consciousness had a quite different relation of the main 'generatrices' of consciousness, i.e. senses and meanings. This, as we shall see, is a relation of estrangement between them, which we may conventionally call disintegrated.

The main change typical of man's consciousness with the development of class society is change of the relation of the plane of senses and the plane of the meanings in which they become conscious.

Another very important change relates to the 'functions' of consciousness, and at the same time to its phenomenal aspect, i.e. the subjective phenomena that constitute its content. From the aspect of the functional development of consciousness this change consists in the forming of inner psychological processes proper. Let us first consider this particular change.

The evolution of language and speech creates the premise for it, so we shall have to return once again to their sources.

The development of men's oral intercourse leads to the rise of vocal actions, i.e. actions that have a special objective, namely vocal transmission or communication of a certain content.

This content is rigorously defined. The development of speech does not, of course, begin with conversations about something or other. Its function is determined by its being embedded in men's collective activity. It consequently realises some content of that activity. What, precisely, is the content of the activity that can be realised in vocal acts? Obviously, only that which relates to the planning, organisation, and control specific to the activity, i.e. which does not constitute its direct, practical realisation. This is the 'phase of preparation' of practical labour activity, which also constitutes its theoretical aspect. The latter is thus distinguished from the direct, practical labour process although it also still remains merged with vocal intercourse.

A new step is the separation of the theoretical, cognitive function of speech from that of intercourse proper, a separation that also begins in the next historical stage. Its historical precondition is isolation of the function of organising production and exchange, and in that connection, too, of the affective function. This circumstance imparts an independent motivation to speech, i.e. converts it into a relatively independent activity.

The development of the division of labour and a certain isolation of mental activity led to vocal acts now no longer realising just intercourse but to their being directed to theoretical ends as well, which made their outward form optional and even unnecessary; subsequently, therefore, they acquired the character of purely internal processes.

These internal processes (inner speech actions, and the inner activity (linguistic in form, and inner operations subsequently formed by the general law of the shift of motives) now operate as purely cognitive processes, viz., as processes of speech thinking or, perhaps, as processes of active remembering, etc.; in short, they form a special group of internal mental processes that are vocal only in the sense that their texture is formed by linguistic meanings capable of being separated from the direct effect of the thing meant.

What the subjective form of these meanings is, i.e. how they are sensually represented in the individual consciousness—whether in the sound image of a word or in an inner visual image—is fundamentally a matter of indifference. Even their inner form is not wholly necessary; thinking can also be based on an external graphic representation of words or on mathematical or chemical formulae; it can

take place as the thinking out loud or as thinking 'with a pen in hand'. From this aspect of the development of the forms of human life what is really essential to these thought processes is that they do not directly transform the material world, that their product, whatever external, material form it acquires, is a theoretical product.

Man, for whom these inner processes are the main content of his activity, can therefore only exist on condition that he receives some of the products of social material production in exchange for the product of his activity. The ideal products of his own activity have to be converted into objects that are not ideas for him. For man himself his theoretical activity thus becomes a means of realising his practical life. It does not follow from that, of course, that his theoretical activity now coincides with the material process of his life; even subjectively, even psychologically, it differs from real practice. It is not that, however, that is important for us now, but something else, viz., that with the separation of mental labour from physical, men's activity in the form of ideas becomes capable of implementing his life.

So a form of activity arises that the old idealist psychology considered the sole 'psychological' one, the sole subject-matter of psychological study. For that reason it is of special interest to analyse it.

As we have already said, the social division of labour led to mental and material activity falling to the lot of different people. At the same time there was a separation of this form of activity from material, practical activity, which was engendered by separation of the personal relations and connections of the individuals whose exclusive occupation it was.

This separation of men's mental activity also found reflection in their heads, so that they began to see in it not a historically arising form of the manifestation of the single process of man's real life, but a manifestation of a special, mental principle that formed a special world, the world of consciousness opposed to the world of matter, the world of extension.

That false, idealist conception of the opposition of mind and matter has played a truly fatal role in psychology, and still does. The erroneous counterposing of mind and matter was expressed in thought and any inner mental activity not being distinguished from the very beginning

as what they are in fact. They did not figure in psychology as a historically engendered form of the realisation of real human life (which constitutes their main content for some people only in certain historical circumstances), but as an allegedly special activity, as a special process opposed in principle to the processes of outward practical activity and completely independent of it.

The inner activity of ideas is, of course, a profoundly unique, qualitatively special activity, but for all that it is genuine activity and not the reflection of a special principle. Mental labour is therefore also precisely labour, even though a special form of it.

This labour is governed by the general conditions of any production, so that it is necessary to pay attention even to the labour time required for it.

> Otherwise (Marx and Engels wrote) I risk at least that the object that is my idea will never become an object in reality, and can therefore acquire only the value of an imaginary object, i. e. an *imaginary value*.[47]

Only as a result of the social division of labour into mental and physical are the conditions created making it possible for the processes of inner activity to be presentable to man as something quite different from those of external activity, as something that constitutes their primordial, eternal opposition.

Analysis of the process of man's historical development thus shows that his life can be manifested, from the aspect of its content most vital for him, in the form of a theoretical activity of ideas and, in certain circumstances, even mainly as such. It produces ideal, mental products, but for man these are transformed into objects that satisfy his practical needs, i.e. into food, clothing, and shelter. The social relations in which this metamorphosis is accomplished separate his ideal activity from the material, practical activity that falls to the lot of other people. When man's ideal activity thereby loses its proper sense for him, by acquiring a gross sense of earnings, he strives all the harder to get a firm footing in another, but also mental, activity, which, moreover, begins all the more to seem to him to belong to a special

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[47] Karl Marx and Frederick Engels. The Holy Family, *Collected Works*, Vol. 4 (Progress Publishers, Moscow, 1976), pp 49-50.

world that can even be represented as the only real one. The more mental and physical labour, and mental activity and material activity, are divided from one another, the less is man able to see in the former the outcome, a copy, of the second, and to see the common nature of their structure and their psychological laws.

That puts its stamp on scientific psychology, too, whose development has long followed the line of research into exclusively inner psychic activity as independent of external activity. Inner psychological processes were therefore treated in a one-sided way, only as determining outward activity; the dependence of the formation of the inner activity itself on external activity, however, was concealed. Even when the moulding of mental processes in a child was being investigated their sources were at best considered to be his sense perceptions; the development of mental acts, however, was represented as an independent process on which the development even of external actions themselves from some sort of obvious material depended. It was overlooked that inner, theoretical processes were originally differentiated within external, outward activity, and only later transformed into a special kind of activity.

The question of whether thought and man's other forms of inner, inward, 'ideal' processes should be considered a form of his activity, or something else, is a most important one, incidentally, for psychology, as regards both its method and a concrete, scientific approach to the psyche.

Psychological analysis demonstrates that inner, ideal activity has the same structure as practical activity. In thinking, too, we should consequently distinguish between activity, acts, and operations proper, and the functions of the brain realising them.

It is precisely because of the commonness of the structure of inner theoretical activity and outward practical activity that their separate structural elements can and do pass into one another, so that inner activity is constantly embracing separate external acts and operations, while developed external, practical activity incorporates inner, thought actions and operations.

When I occupy myself with scientific work, my activity is, of course, a thinking, theoretical one, but during it several objectives become singled out for me that call for external practical activity. Let us assume that I have, for

example, to set up a laboratory experiment (and I mean to set it up, and not to think it up or design it), and that I get about laying wire, driving screws, sawing, soldering, etc.; in mounting the equipment I perform actions that, though practical, nevertheless form part of the content of my theoretical activity and that are senseless without it.

Let us assume, further, that the way of including some instrument or other that forms part of the set-up requires me to pay attention to the level of the general resistance of the electric circuit, and that I mentally calculate this while fixing the leads to its terminals; in that case conversely, a mental operation forms part of my practical action.

The common nature of external, practical activity and the inner activity of ideas is not limited simply to the community of their structure. It is also psychologically essential that they both equally, though differently, link man with the world around him, which is consequently reflected in his head, that both the one and the other form of activity is mediated by a mental reflection of reality, and that they are equally intelligent, meaningful processes. The wholeness of man's life is also expressed in their community.

Only the 'disintegration' of man's life that occurred at a certain historical stage led to the opposing of inner, thought activity to practical activity and created a rupture between them. This relation (rupture) is consequently neither universal nor eternal. In man, whose life is not limited simply to mental labour but is many-sided, embracing varied forms of activity, including physical activity, his thinking also has a many-sided character. It is therefore not fixed simply in the form of abstract thought, and the transition from thought to practical activity is made as a wholly natural act. 'From the outset it [thought—*Tr.*] is always a factor in the total life of the individual, one which disappears and is reproduced as *required.*'[48]

It is most important for psychology to bring out the community of structure of mental and practical activity, and the community of their inner connection with the reflection of reality. That enables us, in particular, to understand how, with all-round development of man's personality, a harmonious uniting of these historically differentiated forms of activity is psychologically possible.

[48] Karl Marx and Frederick Engels. The German Ideology. *Op. cit.*, p 263.

The first change in consciousness, which was brought about by the development of a social division of labour, thus consists in the separation of mental, theoretical activity.

Consciousness, moreover, is altered, as regards its functional structure, in that man becomes aware as well of the inner links of his activity, which thereby get the chance to develop to the full. They acquire a relative independence, become purposive, controlled, and consciously motivated, i.e. develop into a special kind of activity. Subjectively, man's psyche now figures as thought, as mental activity in general, as an aggregate, reservoir, or subject of inner psychic processes. Classical psychology also depicted it thus.

Another and, moreover, very important change in consciousness is, as we have already said, the change in its inner structure. That comes out especially clearly in the conditions of developed class society. Its foundation is the separation of the bulk of the producers from the means of production that occurs in those conditions, which transforms men's relations more and more into ones purely of things that are separated ('alienated') from man himself. As a result his own activity also ceases to be for him what it in fact is.

This 'alienation' comes about through the development of forms of property and relations of exchange. Man's labour was not originally separated from its material conditions. Man was united with these conditions, which were objectively the *sine qua non* of his life, by a natural relationship. But the development of the productive forces inevitably dissolved this relationship, which was also expressed in the development of forms of property. So a dissolution of the worker's original relation to the land, the instruments of labour, and labour itself, came about.[49] The bulk of the producers, finally, were converted into hired labourers, whose only property was their capacity to work. The objective conditions of production were now opposed to them as another's property. They could therefore live and satisfy their vital wants only provided they sold their

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[49] See: Karl Marx, *A Contribution to the Critique of Political Economy* (Progress Publishers, Moscow, 1978), pp 188-217.

labour power, i.e. alienated their labour. But labour was the most intrinsic content of their life; they consequently had to alienate the very content of their life.

The same process that led to separation of the producers led on the other hand to a separation as well of the conditions themselves, which appeared as the property of capitalists in the form of capital. The capitalist now also personifies these conditions, which, as far as the worker is concerned, are opposed to him, the worker. But the capitalist's capital also has its own existence separate from the capitalist, which takes possession of his own life and subordinates it to itself.

These objective conditions, engendered by the development of private property, also determine the features of man's consciousness in the conditions of class society.

The traditional psychologist, of course, refuses to consider them, seeing in them only a relation of things. He demands that psychology should, come what may, remain within the context of the 'psychological', which he understands purely as subjective. He even reduces psychological study of man's industrial activity to investigation of its 'psychological components', i.e. of those psychic features for which engineering presents a demand. He is unable to see that industrial activity itself is inseparable from people's social relations, which are engendered by it and determine their consciousness.

But let us return to our analysis of these relations.

A consequence of the 'alienation' of human life that has occurred is the emergent disparity between the objective result of man's activity on the one hand, and its motive on the other. In other words, the objective content of the activity is becoming discrepant with its subjective content, with what it is for man himself. That also imparts special psychological features to his consciousness.

The activity of the primitive beater is subjectively evoked by his share in the common bag, which corresponds to his needs; the quarry is, at the same time, the objective result of his activity in connection with the group's activity. The hired worker in capitalist production is also subjectively striving to meet his need for food, clothing, shelter, etc., as a result of his activity, but its objective product is something else altogether. It may be the gold ore that he mines, or the palace that he builds.

> What he produces for himself is not the silk that he weaves, not the gold that he draws from the mine, not the palace that he builds. What he produces for himself is *wages*, and silk, gold, palace resolve themselves for him into a definite quantity of the means of subsistence, perhaps into a cotton jacket, some copper coins, and a lodging in a cellar.[50]

His labour activity itself is transformed for him into something different than what it is. Its sense for him does not now coincide with its objective meaning.

Does the worker in capitalist production know, for example, what weaving or spinnings is? Does he possess the appropriate knowledge and meanings? Of course he does, at least in so far as what is needed to weave, spin, or drill intelligently, in short to perform the labour acts that constitute the content of his work. But weaving does not have the subjective sense of weaving for him, or spinning of spinning.

> The twelve hours' labour, on the other hand, has no meaning for him as weaving, spinning, drilling, etc., but as *earnings*, which bring him to the table of the public house, into bed.[51]

So weaving has the objective meaning of weaving for him and spinning of spinning, but that is not the special feature of his consciousness. His consciousness is characterised by what the relation of these meanings is to the personal sense his labour actions have for him. We already know that sense depends on motive; consequently the sense of weaving or spinning for the worker is determined by what induces him to weave or spin. His conditions of life, however, are such that he does not spin to satisfy a social need for yarn, does not weave to meet a social need for cloth, but for wages; that also imparts sense to weaving for him, and to the yarn and cloth produced by him.

Although the social meaning of the product of his labour is not hidden from him, it is a meaning foreign to the sense this product has for him. So, if he is given the chance to choose work, he finds himself forced to choose primarily between higher or lower pay, more reliable or less reliable earnings, rather than between spinning or weaving.

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[50] Karl Marx. Wage Labour and Capital. In: Karl Marx and Frederick Engels. *Collected Works*, Vol. 9 (Progress Publishers, Moscow, 1977), pp 202-203.

[51] *Ibid.*

This point is revealed ever more and more clearly, together with the worker's mounting feeling of uncertainty about tomorrow and his feeling of dependence on conditions that have nothing in common with the content of his labour. According to contemporary psychological research abroad, English women factory workers' estimate of the permanence of work takes first place in their appraisal of a job. Other facts indicate the same thing. Workers, for example, reluctantly accept retraining for other jobs organised by industrial companies precisely because it undermines their feeling of security in their old job.

The foreignness of meanings to the sense behind them also comes out of course at the opposite pole of society. For the capitalist, for instance, the whole sense of spinning and weaving consists in the profit he will make from them, i.e. in a thing devoid both of the properties of the output of production in itself and of its objective meaning.

The alienation of people's personal relations and their conversion into a relation purely of things comes out particularly clearly in the power that money, the universal means of exchange, has acquired over man.

> The less you eat, drink, and buy books; the less you go to the theatre, the dance hall, the public house; the less you think, love, theorise, sing, paint, fence, etc., the more you *save*—the *greater* becomes your treasure which neither moths nor rust will devour—your *capital*. The less you *are*, the less you express your own life, the more you *have*, i. e. the greater is your *alienated* life, the greater is the store of your estranged being.... All the things which you cannot do, your money can do. It can eat and drink, go to the dance hall and the theatre; it can travel, it can appropriate art, learning, the treasures of the past, political power—all this it *can* appropriate for you—it can buy all this: it is true *endowment*.[52]

Everything acquires a dual aspect under the dominance of private ownership of the means of production, viz , both man's own activity and the world of objects around him.

The picture that an artist puts all his skill into, he has to paint in order to convert it into money, into a thing that has nothing in common with painting. Nevertheless the picture retains its real sense for the rich industrialist who buys it. For him it may, perhaps, acquire the sense of a

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[52] Karl Marx. Economic and Philosophic Manuscripts of 1844. In: Karl Marx and Frederick Engels. *Collected Works*, Vol. 3 (Progress Publishers, Moscow, 1975), p 309.

thing in which he wants to invest some of his money, or of a thing testifying to the prosperity of his firm.

The doctor who buys a practice in some little provincial place may be very seriously trying to reduce his fellow citizens' suffering from illness, and may see his calling in just that. He must, however, want the number of the sick to increase, because his life and practical opportunity to follow his calling depend on that.

This dualism distorts man's most elementary feelings. Even love proves capable of acquiring the most ugly forms, not to mention love of money, which can become a veritable passion.

The penetration of these relations into consciousness also finds psychological reflection in a 'disintegration' of its general structure characterised by the rise of an estrangement between the senses and meanings in which the world around man and his own life are refracted for him.

Whatever concrete, historical feature of man's psyche under the dominance of private property relations that we take (whether thought, interests, or feelings), it inevitably bears the impress of this structure of consciousness and can only be properly understood from its peculiarities. To ignore these peculiarities and remove them from the context of psychological research is to deprive psychology of historical concreteness, converting it into a science solely of the psyche of an abstract man, of 'man in general'.

What we said above about the general structure of man's consciousness under capitalist production does not yet give anywhere near a full psychological description of it. To make any progress in that respect we must pay attention to at least the following two circumstances.

(1) The first circumstance is created by the nature of the alienation of man's activity itself. The point is that the 'alienated', is not, of course, what has simply ceased to exist for me. Alienated labour, for example, is by no means labour that does not exist for the worker. It exists for him, of course, and, moreover, forms part of his life in two ways: negatively and positively.

It forms part of his life *negatively* because this labour takes part of his life away from him, because, for him, to work does not mean to live. 'Life begins for him where this activity ceases, at table, in the public house, in bed.'[53]

[53] Karl Marx. Wage Labour and Capital. *Op. cit.*, p 203.

It is *positive* in two respects.

(a) It is positive as the means of his activity. They constitute real wealth, the 'technical' side, so to speak, of his life; it is the wealth of knowledge, skills, and know-how that he must possess in order to perform his labour activity.

(b) It is positive as a condition of the enriching of his life with a new content quite different to that proper of his alienated activity, but nevertheless engendered precisely by it. The worker in a capitalist mill not only alienates his labour; he enters into relations with other people in that way—with the person exploiting his labour on the one hand, with his fellow-workers on the other hand. And these, of course are not simply 'theoretical' relations, but are embodied for man above all in the class struggle that he has to wage at any stage of the development of class society —as slave, as serf, or as proletarian. This struggle goes on at any social pole—at that of supremacy and at that of enslavement or subjugation.

The development of this struggle at the pole of supremacy is the evolution of ever greater inhumanity in man, and we now know to what terrible limits this inhumanity can develop.

At the opposite pole of the development of this struggle is the evolution of the truly human in man. In capitalist society, therefore,

> the worker must choose, must either surrender himself to his fate, become a 'good' workman, heed 'faithfully' the interest of the bourgeoisie, in which case he most certainly becomes a brute, or else he must rebel, fight for his manhood to the last, and this he can only do in the fight against the bourgeoisie.[54]

The practical movement that expresses this indignation leads to real unity of individuals; they recover their human essence, in their mouths human brotherhood becomes a truth, and then 'the nobility of man shines upon us from their work-hardened bodies'.[55]

The character of workers' relations with one another creates a sense (*Sinn*) of collectiveness which also per-

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[54] Frederick Engels. The Condition of the Working-Class in England. In Karl Marx and Frederick Engels. *Collected Works*, Vol. 4 (Progress Publishers, Moscow, 1975), p 416.

[55] Karl Marx. Economic and Philosophic Manuscripts of 1844. *Op. cit.*, p 313.

meates their attitude to work; therefore only among workers is consciousness of labour, even with alienation of its product, truly moral. Although the worker is forced to sell his labour power, labour is never, for him, converted simply into a commodity.

(2) The second circumstance that needs to be pointed out is the following. While part of the worker's life is alienated along with practical alienation of his labour, and this finds reflection in his consciousness, the real relations, on the other hand, retain their human sense for him. This sense does not escape him, and is not dressed up in a mystic envelope of religion. His spiritual ideals and his morality are human, his consciousness needs no religious notions, which remain empty for him, devoid of sense.

> If he chances to have any religion he has it only in name, not even in theory. Practically he lives for this world, and strives to make himself at home in it.[56]

Because there are no motives in the worker's activity by which another person might lose his sense for him and acquire simply the significance of a thing, the worker is much more humane in his everyday life than the capitalist.

> 'To them (the workers—*ANL.*) every person is a human being, while the worker is less than a human being to the bourgeois.'[57]

The worker experiences a feeling of hatred and anger for enslavers but these feelings in no way express a loss of humanity.

> This rage, this passion, is rather the proof that the workers feel the inhumanity of their position, that they refuse to be degraded to the level of brutes.[58]

What the workers are completely free of is the 'reverence -or money', the 'religion of capital'. Money has no special ense of its own for them, and although they are forced all he same to work for its sake,

> for them money is worth only what it will buy, whereas for the bourgeois it has an especial inherent value, the value of a god.... Hence the workman is much less prejudiced, has a clearer eye

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[56] Frederick Engels. The Condition of the Working-Class in England. *Op. cit.*, p 421.

[57] *Ibid.*, p 420 footnote.

[58] *Ibid.*, p 414.

for facts as they are than the bourgeois, and does not look at everything through the spectales of personal selfishness.[59]

So a closer examination of the general picture of man's life in capitalist society brings out not only its dual character but also its inner contradictoriness.

Man's life in these conditions is not simply split into its inherent content and into a content alien to it. For man himself his *whole* life remains an integral one. It therefore also takes the form of an inner struggle in which his resistance to this relation that subordinates him to itself is expressed. The mutual foreigness of senses and meanings in consciousness is directly hidden from man, and does not exist for his introsprection. It is discovered to him all the same, but only in this form, i.e. as the processes of inner conflict that are usually called contradictions of consciousness and sometimes, more expressively, torments of consciousness. These are processes of becoming aware of the sense of reality, processes of establishing the personal sense in meanings. Let us consider them first in their simplest form.

The discrepancy originally arising between the human group's relations to the reality around it, on the one hand, which is generalised in a system of linguistic meanings, and the personal relations of individual people, on the other hand, which form the sense of what is reflected for them, already complicates the process of awareness. In certain conditions this process takes on very fanciful forms, as we have seen, of the nature of 'participations'.

Consciousness may develop in these forms as universals, but only to a certain limit. The complication of production, and in connection with that the extension of positive knowledge of nature, inevitably leads to a development and differentiation of meanings, which consists in meanings now more and more reflecting the objective relations between objects, to which the socially developed technical modes and means of human activity are subordinated. At the same time they are more and more freed from social relations to the cognised phenomena crystallised in them.

These relations are now sometimes reflected in special meanings, and sometimes, too, this content is reflected *by means of* meanings rather than in the meanings themselves. To understand that we must, at the same time, allow

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[59] Frederick Engels. *The Condition..., Op., cit.*, pp 420-421.

for the concomitant change in the forms of language and social consciousness.

From the aspect of the history of language this is associated with the technicisation of language (Abayev), which consists in words not directly bearing a reflected content, because of the development of language, but of transmitting it indirectly. From the angle of the history of social consciousness this is associated with the fact that 'the ideology expressed in a language is succeeded by an ideology expressed by means of language'.[60]

One and the same system of linguistic meanings thus proves capable of expressing a different, and even opposite content. Even the root difference in men's ideas and thoughts that inevitably arises in class society therefore does not also require different languages and different systems of linguistic meanings to express it. There are, of course, a difference and oppositeness in how the slave and the slave-owner, the peasant and the feudal lord, the worker and the capitalist imagine the world, but it in no way calls for such a difference in their language, in the verbal meanings which they possess, and is by no means reduced to them.

From the psychological aspect, from the aspect of the process of consciousness, this is connected with the fact that this process now takes on an expanded and developed character. For consciousness of the sense of a phenomenon being disclosed is only possible in the form of awareness of the phenomenon; as we have said many times, a sense that is not embodied in meanings is not yet sense that has become conscious for man. This establishing of sense in meanings is now transformed from the process of its simple concretisation in meanings into a very complex one that is, as it were, the resolution of a particular psychological task.

This task sometimes becomes painfully difficult. The 'torment of the word', the agony of objectifying sense in meanings, the pangs of becoming aware of the sense when, as Dostoyevsky put it, 'the idea won't go into words', have been described many times in the scientific literature and in fiction. They are by no means the same as the creative torment of thinking; they are the torment precisely of con-

[60] V. Abayev. Language as Ideology and Language as Technique. In *Yazyk i myshlenie*, Vol. 2 (Leningrad, 1934), p 50.

sciousness, of becoming aware. It is therefore in vain to seek their nature in the nature of cognitive activity proper.

Their nature does not lie simply in the process of establishing sense in meanings now taking a very complicated form; for the complication of the process creates, on the contrary, very broad possibilities. Their true nature lies in the contradictoriness of the content of man's life itself; it is associated at the same time with the limited nature of social, now class, consciousness.

We have already seen that man does not simply face tasks of becoming aware of the world around him, and of his life and himself in that world. His individual consciousness is only possible in conditions of social consciousness, in assimilating which he reflects reality, as it were, through the prism of socially developed meanings, i.e. knowledge and notions. With developed 'technicised' language, moreover, man does not simply master a range of linguistic meanings. He does so by assimilating the system of ideas and views that they express. Otherwise it would be quite impossible psychologically to master them. In other words, mastery of a system of linguistic meanings is, at the same time, as well, mastery of a more general ideological content, i.e. mastery of meanings in the broadest scope of the term.[61]

As we know, the dominant ideology in class society is the ideology of the dominant class, which reflects and consolidates the existing social relations. But we have already seen that these relations become enslavers of man, subordinating his life to themselves and creating inner contradictions in it. Just as the embodiment of human life in these relations is not its complete, genuine embodiment, so, too, the embodiment of senses engendered by man's life in meanings that reflect these relations that are alien to it is incomplete and untrue. That also creates the incompleteness and inadequacy of consciousness and of becoming conscious.

We must stress that although we are concerned here with the inner inadequacy of consciousness, its incompleteness and inadequacy cannot be eliminated in any way other

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[61] We once again draw readers' attention to our dual use of 'meaning'—sometimes as the meaning of a word (verbal meaning) and at other times as knowledge, as the content in general of social consciousness assimilated by the individual.

than through a practical change in the objective conditions that engender this inadequacy; or rather, if those conditions are preserved, they can be eliminated only at the price of isolating consciousness from real life or through active struggle against the conditions themselves.

Man strives to eliminate the disintegrated nature of his consciousness. He does not strive for adequacy and truthfulness in his consciousness, moreover, in any way from an abstract love for truth. It is his striving for true life that is expressed in that; that is why it is so intent, and why it sometimes imparts such a really dramatic character to the processes of becoming conscious—to the most cherished processes of man's 'inner life'.

This striving is different, however, at the different social poles, takes dissimilar forms, and has a dissimilar outcome.

At the pole of the ruling classes it takes the form of man's denial of himself and his life, and therefore cannot be in any way permanent or lasting; the main point is that this striving is powerless and can only be realised in an illusory way, only in emotion.

Maxim Gorky demonstrated its negative form and its weakness in the image of the Gordeyevs and his portrait of Bugrov.

Ignat Gordeyev's whole life was dedicated to the accumulation of capital, and in that his cupidity and cruelty knew no bounds. In periods of passion for business he treated people harshly and mercilessly; 'he went about snatching up hundreds and thousands of roubles'. These periods were succeeded by others when he broke away from the shifting turns of affairs and another light was suddenly shed on everything for him. 'Ignat Gordeyev seemed to sense that he was not the master of his affairs but their lowest despicable slave. And another spirit awoke in him—the fierce.' 'He seemed to be tearing at the chains he had forged and clamped on to himself, tearing wildly at them without being able to break them.[62] Drinking bouts would begin, then days of repentance and prayer. "Dear Lord, Thou sees everything," Ignat would murmur at last, pressing...."'[63]

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[62] Maxim Gorky. Foma Gordeyev. In: *Collected Works* in ten volumes, Vol. II (Progress Publishers, Moscow, 1978). pp 7-9.

[63] *Ibid.*, p 10.

Gorky recorded the words of a Russian millionaire, merchant Bugrov: 'Another time, you come to your senses from the bustle of the day, and suddenly—your soul trembles, and you meekly think to yourself: "O Lord, does everyone, or most people, live in such dark clouds as you yourself?"'[64]

'It was strange to know,' Gorky remarked, 'that this man lived by the labour of thousands of people, and at the same time to hear this labour was unnecessary, was senseless in his eyes.'[65]

This impotence of the striving for adequacy of consciousness is only a reflection of the objective inadequacy of man's real, living relations. Psychologically it is explained in a twofold way, both by distortion of the senses created by the relations of things to which man's life is subordinated, and by the system of meanings, the ideology, that reflects precisely these 'untrue' relations of things. For Gordeyev's life really remained one of the piling up of capital and took on substance in that. In its embodied form it subdued even his most intimate feelings and desires. He passionately wanted a son, but even that wish—so human!—acquired a distorted, purely possessive sense, '"It's a son I want, can't you understand that? A son and heir! Who'll I leave my money to when I die?..." And he would grow peevish and morose.'[66]

At the pole of labour the striving for adequacy of consciousness is, on the contrary, the psychological expression of a real, living striving. It does not oppose itself, does not negate the real content of man's life, but cofirms its fullest development.

Labour, we know, acquires an ever more collective nature with the development of capitalist production; vast masses of workers are united, and close ranks, in the practical struggle against the bourgeoisie. In those conditions, which are workers' life conditions, nothing any longer remains of the conditions that confirmed these dominant relations in their consciousness. Even the last patriarchal-like threads that disguised their true character have proved broken.

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[64] Maxim Gorky. Sobranie sochinenii v 18 tomakh (*Collected Works* in 18 volumes). Vol. 18, Khudozhestvennaya literatura, Moscow, 1969, p 119.

[65] *Ibid.*, p 210.

[66] Maxim Gorky. Foma Gordeyev. *Op. cit.*, p 11.

All that leads to both these dominant relations and the elements of new relations hidden in them emerging in their real, true sense for workers.

Initially, however, this sense is not adequately realised. To be realised it has to be embodied, to become socially developed meanings for consciousness that would reflect the real nature of the relations. But the meanings, i.e. notions and ideas that are dominant in these historical conditions are those that express bourgeois ideology. They are, therefore, of course, foreign to this sense. Their rooting in the consciousness of the masses also creates its psychological inadequacy and 'untruthfulness'.

We have already mentioned the point that any inadequacy of consciousness or awareness is not an unimportant fact, but, on the contrary, hides an inadequacy of life itself, because consciousness is not only an 'epiphenomenon', not only a 'side effect', but also the *sine qua non* of life. A striving to overcome this inadequacy is therefore inevitably created.

The striving for adequacy of consciousness, however, takes a special form at the pole of labour in the historical conditions we are considering, that differs radically from the forms we observe at the pole of capital. It does not give rise to a negation of, and withdrawal from, real life, to a loss and distortion of its sense for man, but to denial and rejection of the inadequate meanings that interpret this life in a distorted way in consciousness. At the same time it creates the psychological soil for assimilating adequate meanings and an adequate ideology, creates what emerges objectively as an attraction to a socialist ideology and to a scientific socialist consciousness.

The reason for this is that the sense of existing objective relations, if it may still be adequately realised in workers' consciousness, and still has the form of unconscious sense, the form of instinct, is later realised in their practical life—in spontaneous struggle, in workers' practical uniting and associating together. Being the real sense of existing relations, it is *effective*. The difficulties and contradictions of consciousness therefore do not take the form of helpless indignation with oneself, or of helpless emotion, but the form of indignation against the ideology that subordinates consciousness to itself and of a striving for true understanding, and knowledge. This indignation of

workers against the fetters of capitalist ideology, and this instinct for true understanding, are well known and there is no need to give examples.

From the psychological standpoint we have an essentially new correlation here of the main generatrices of the inner structure of consciousness brought out above, though still within the limits of its previous general structure. It is expressed in the new role of the meanings and ideas assimilated, and in the emphatic force that they are able to acquire by adequately reflecting real relations.

The ideas that express these real relations, i.e. those of scientific socialism, which form a new socialist ideology under capitalism, are, as we know, developed by people who know science, who are eminent scientists, and who, at the same time fully understand the sense of the working-class movement.

The great role of the ideas of scientific socialism is comprehensively disclosed by the Marxist teaching on the inculcation of socialist consciousness in the spontaneous workers' movement. We would simply like to stress once more a most important psychological moment typical of consciousness at this historical stage of its evolution, which is the new relationship arising between senses and the meanings and ideas now embodying them that we have just noted and that imparts a special role to them in life.

This relationship is such that man's becoming aware of senses, which occurs within the system of these meanings, gives his actions new psychological features. They seem once more to get the full force and naturalness of instinct, and at the same time to retain the rationality and clarity of aims inherent in developed human activity.

The mounting force of these features is a kind of 'psychological enigma' for capitalist ideologists. Its link with spread of the ideas of scientific socialism, however, is sufficiently clear to them for them to increasingly step up their struggle against these ideas.

This strength is finally converted, in certain historical circumstances, into a force of historical action that destroys the domination of private property relations and emancipates man's labour. This practical annulment of the relations of private property and practical emancipation of human labour, which brings about the 'reintegration' (as Marx put it) of man himself, leads to a reintegration of his con-

sciousness as well. So there is a transition to a new, inner structure of consciousness, to a new 'formation' of it, viz. to the consciousness of socialist man.

The main psychological change here once again consists in a change in the main relation of consciousness, i.e. the relation between sense and meanings. Like any change in a meaningful relation, it is impossible without a change in what is related, but it does not affect both parts of the relation concerned in the same way.

Its basis is the practical return of the subjective content of activity, i.e. of the real sense of activity for man, to objective activity, and the wiping out of the discrepancy and contradiction between them, that comes about as a consequence of the elimination of private property in the means of production.

The socialist worker, just like the worker in a capitalist undertaking, is occupied in weaving, spinning, etc. but for him this work has the sense precisely of weaving, spinning, etc. Its motive and its objective product are not now foreign to each other for him, because he is now working not for exploiters but for himself, for his class, for society.

The socialist worker receives wages for his work, so that his work also has the sense of earnings for him, but the pay is only a means for him to realise some of the output of social production for his personal consumption. This change in the sense of labour is engendered by its new motives.

The new motivation of labour is also a new attitude to the task of mastering the technique of labour, the instruments of labour, and production operations. As a relation of consciousness it is one of the sense of labour and of the corresponding range of concrete meanings, knowledge. These concrete meanings—knowledge and know-how—now lose their foreignness to the sense of labour. Possession of them ceases to be simply a condition for earnings or, if we have the capitalist employer in mind, a condition for making profit, i.e. it is a condition in both cases for getting results that have nothing in common with the essence of production itself and its product. These concrete meanings emerge for man in their reality, in their own content as a condition of high productiveness, of productivity. The thirst for knowledge now, understandably, becomes much stronger.

This is a necessary condition of the forming of the new man's consciousness: for the new sense must be realised

psychologically in meanings; for sense not objectified and concretised in meanings and knowledge is not yet conscious, is not yet a sense that fully exists for man. The new sense of labour is also realised in mastering what is called the culture of labour and that which constitutes its intellectual aspect.

The realm of meanings now emerges quite differently for man. Objectively it is expressed in this, that whereas, on the one hand, there is mastery on the broadest scale of the wealth of experience of human practice crystallised and reflected in this realm, on the other hand this wealth now seems to appear to people in the light of new personal senses. Everything genuine in it is brought out with emphasised force in consciousness and develops rapidly, while the illusory loses sense and fades.

The new inner structure of consciousness arising, i. e. its new 'formation', above all also has this new relation of senses and meanings. The new relation is by no means a return to their original simple coincidence, to their simple fusion. It retains a developed form of complex transitions from the one to the other. There is only a change of sorts on the plane of senses that abolishes the phenomenon of the disintegrated character of consciousness. Man's consciousness now becomes integrated in structure.

Does this characteristic of the structure of consciousness constitute its truly *psychological* one? That point arises because the characteristics of consciousness include a relation with social consciousness and its ideological content that in itself is not, of course, the subject-matter of psychology. A tool, for example, is, however, not in itself a 'psychological' object, but the inner structure of intelligent tool activity, like the process of handling a tool, has an undoubted psychological content. In implementing man's activity a tool so reconstructs it that its more elementary constituent processes are thereby altered.

The separate acts are altered—both the outward, practical ones and the inner, theoretical ones; the change of actions, too, gives rise to a development of their modes and operations, and consequently of the meanings as well in which they are crystallised for consciousness. Finally, as modern experimental research has shown, the most elementary functions, too, are altered, depending on the operations that they realise; suffice it to mention, for example, that the

thresholds of sensations can sometimes be altered several times over depending on what place a given form of sensitivity occupies in an activity and how the corresponding sensory operation enters into it.

It is this strictly objective dependence of partial processes on the general structure of man's activity and consciousness determined by the concrete, historical conditions of their lives that also makes the change in human qualities and forces taking place before our eyes psychologically understandable, qualities and forces that are creating a new psychological image of man himself. Is it possible, for example, not to see the inner link between the fact that men's real community has been disclosed to them without further distortion by the material form of their relations with one another, and the fact that previously dominant feelings have begun more and more to give way to new, genuinely human feelings?

For the difference between senses and motives is always also a difference between will and feelings. The brave deed whose motive is to enslave another man, to seize another's possessions, or to get promotion, and the courageous action whose motive is to help the common cause have quite different psychological qualities of course. But there is also a psychological difference between great exploits when they are done under a contradiction in the whole of life (and therefore seemingly only in one sphere of the personality), and feats in which man's personality is expressed in all its natural integrity and fullness; for only on that condition can the exploit's moral force and inner beauty be perfect.

By ignoring the dependence of the separate peculiarities and features of man's psyche on the general character of his consciousness determined by the conditions of his real life, psychology in fact inevitably comes to deny their historical nature. In trying to reduce man's psychological image to his separate capabilities and qualities, psychology takes a direction in its research opposite to that of their actual forming. Everything therefore appears upside-down in it; the determined is depicted as the determinant, effect as cause. It sees even the motives of human activity in the subjective experiences engendered by them: in feelings, in the excitement of interest or attraction. Continuing its analysis in that direction, psychology finally finds the source

of these experiences in the emotions and inclinations engendered in man, and in the peculiarities of his instincts.

The line that historical analysis opens up shows, on the contrary, that the human psyche's properties are determined by man's real relations with the world, which depend on the objective, historical conditions of his life. These relations also create the features of human consciousness's structure that reflects them and that characterises men's psyche in its actual social essence.

Without going into the problem of tracing the concrete history of the evolution of man's psyche, we have limited ourselves simply to a very short sketch of its most common, historical 'formations' Even so this sketch has shown that what seems at first glance to be immutable in man is in fact only a transitional stage in his historical evolution. It makes it possible, moreover, to see something else, viz., that really free, really all-round development of human consciousness only begins with its 'reintegration', which comes about through a radical reform of society.

A new psychological structure of consciousness does not, of course, arise suddenly and immediately after a change in the conditions of being. It also does not arise of itself, spontaneously, without struggle and without an educating of people, without socialist ideology being inculcated in their consciousness. Active training of new psychological qualities, on the contrary, is a very necessary condition of its becoming.

The metamorphosis taking place in consciousness does not immediately embrace all aspects of man's life or all his relations with the world. Here, as with the first display of consciousness, it does not happen so that all reality is suddenly being illuminated as it were by a new light; much still appears at first in the old light because meanings, notions, and ideas are by no means altered by themselves, automatically, as soon as they lose their roots in life's objective conditions. They may retain the force of prejudices for man, sometimes requiring persistent struggle to undermine them in his consciousness.

On the other hand, the 'reintegration' of consciousness occurring is by no means, as we have already said, a transition to coincidence, to simple coherence of the systems of personal senses and meanings in man's consciousness. The inner work, which is that of becoming aware of, objectivi-

sing subjective, personal attitudes to reality and to the system of socially developed meanings, is not only preserved but also does not become less complex and tense. There is only a sort of shifting of it to the sphere of more diverse, more profound, and finer living relations, which man must become aware of for himself and, as it were, 'find himself' in.

So men's consciousness evolves psychologically, changing qualitatively, so that its old features die out and new ones take their place. At the dawn of human society man's consciousness reached the stage of its primitive formation; only the subsequent development of the social division of labour, of exchange and forms of property, led to the evolution of its inner structure; at the same time, however, it made it limited and contradictory; a new time has arrived—a time of new relations giving rise to a new consciousness in man, and it is still difficult for us to imagine the whole vastness of the outlook for its future growth.

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To end this short sketch it remains for us to sum up some of the theoretical conclusions regarding the fundamental approach to the psyche.

The points that we were able to cover did not, of course, exhaust even the most important content of the psyche's evolution. Our sketch cannot, therefore, pretend to be an essay on the *history of the psyche's* evolution; the task that it has attempted is that rather of presenting a sketch of the *theory* of psychic development, or more exactly of investigating the actual principle of an historical approach to the psyche.

What are the general conclusions that we have come to?

The traditional approach to the psyche starts from a difference in phenomena and processes of a dual kind. The first kind are the inner processes and phenomena that we find within ourselves, viz., sense images, concepts, emotional experiences, and at the same time processes of thinking, imagination, voluntary recall, etc. All these belong to the sphere of the psychic. It is they that constitute in the aggregate Descartes' famous '*cogitatio*'.

> By the word 'to think' I mean everything that happens in us in such a way that we perceive it immediately in ourselves;

that is why not only to hear, to wish, and to imagine, but also to feel, are the same thing as to think.[67]

The other kind is the phenomena and processes that, unlike those of the first type, form the external material world. They include the material reality surrounding man, and equally his own body and the physiological phenomena and processes taking place in it. In their aggregate all these phenomena and processes constitute the sphere of the physical, the world of 'extension'.

Thus two groups of phenomena and processes proved to be opposed to one another, and allegedly it is only the first that is subjected to study in psychology. What then constitutes the specific difference between this group and physical phenomena and processes? It is their purely subjective nature, i. e. that they allegedly exist simply as data of the subject's direct inner experience and have no other existence; for any other form of existence would already be their existence in the physical world, in the world of extension, and not of thought.

The approach to the psyche that begins with this distinction quite inevitably, and with certain reservations, completely closes the book of man's practical, sensory activity to psychology, without which psychology (as Marx remarked) cannot become a really meaningful and real science.[68]

There is also another approach to the psyche. Its philosophical basis is the theory of reflection. This approach also relies on a certain initial difference, that between the material subject of life and the objective reality of things in which the subject lives, i. e. with which he constitutes a special form of material interaction. In other words, from the standpoint of this approach, the subject is not opposed to the world like Fichte's 'Ego' but is linked in practice from the beginning with it; life and the subject's vital activity really link him with the object, implementing their interconversions, which are originally expressed simply as metabolism.

At a certain level of development of the material subject's life, specific phenomena necessarily also arise that

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[67] Rene Descartes. *Les principes de la philosophie*. Première partie (Belin, Paris, s.a.), pp 43-44.

[68] See Karl Marx. Economic and Philosophic Manuscripts of 1844. In: Karl Marx and Frederick Engels, *Collected Works*, Vol. 3 (Progress Publishers, Moscow, 1975), p 303

reflect the properties of objective reality in their connections and relations, i. e. reflect reality in its physical materialness. This is the psychic form of reflection.

Psychic reflection, taken in the system of connections and relations of the matter of the subject himself, is only a special state of this matter, a function of his brain; taken in the system of the subject's links and relations with the world around him, it is an image of this world.

There is thus a real process in which the reflected engenders a reflection, the ideal. This process is also the material process of the subject's life expressed in those processes of his activity that link him with the objective world.

It is in consequence of the fact that activity in practice links the subject with the surrounding world, affecting it, and being subordinated to its objective properties, that phenomena arise in him that are an ever more adequate reflection of this world. In so far as the activity is mediated by these special phenomena and is, as it were, pregnant with them, it is animate activity.

At a certain, relatively late stage of evolution activity may be interiorised, i. e. may also acquire the form of an inner activity of ideas, but it remains a process implementing the real life of a real subject and does not become 'purely' mental, opposed in principle to external, directly practical activity. The absolutising of the opposition between them characteristic of traditional idealist psychology is only an ideological expression of the actual separation of mental and physical labour that occurred during the evolution of society, a separation that in fact has the same non-absolute, historically transient character, as the economic relations that gave birth to it.

This approach thus rejects the dualist opposing and isolation of inner, theoretical activity from outward, practical activity. It calls on the one hand for a clear differentiation between reflection proper, as an image of reality (in whatever form this reflection arises, whether as sensation, a concept, or some other form), and the processes proper of activity, including inner activity.

To reject this separation and confusion is at the same time to reject the idealist conception of the psyche expressed by them. It enables us to overcome the idea of the psyche as something that has a special existence of its own thanks to which it can allegedly form part of material processes,

interact with them, implicate something in itself, etc. It is necessary to stress that specially, and to add a rider, because the very mode of expression of psychological concepts and relations to which we have become accustomed bears the stamp of this conception. We usually say, for instance, that something 'happens in our consciousness', etc., but that, of course, is only unavoidable homage to linguistic tradition.

From the standpoint of this approach to the psyche, the real history of its evolution emerges as the history of the development of a 'split' in the formerly simple unity of life, the beginnings of which gave rise to the primitive psyche of animals, and which ultimately found full expression in man's conscious life. This history is, as we have seen, a reflection of the history of the evolution of life itself and is governed by its general laws: at the stages of biological development by the laws of biological evolution, and at the stages of historical development by socio-historical laws.

We think the historical approach to psychology can make it a science that is not cut off from the great vital tasks of building a new life, but will really help resolve the problems of building emancipated man's life, guiding him to a higher, all-round, harmonious development of all his faculties and qualities.

A PROPOS THE HISTORICAL APPROACH TO STUDY OF THE HUMAN PSYCHE

1. Naturalistic Theories in Human Psychology

It is hardly possible to point to a psychological investigation these days that does not reckon in one way or another with the fact that human behaviour and consciousness are subject to the effect of socio-historical conditions, and alter with a change in the latter.

Even research devoted to narrow, psychophysiological problems has to allow for the effect of social influences—verbal instruction, the experimenter's evaluation of the subject's achievements, etc. In some fields of psychology, too, study of the determining of the psyche by social conditions constitutes the main problem. Such, for example, is the field of study devoted to the historical development of man's psyche and the mental development of children; it also includes educational psychology, the psychology of speech and human relationships, and the psychology of the personality.

The general theoretical significance of the problem of the psyche's social conditioning is also perfectly obvious. It is another matter how, specifically, this problem is treated and what place is allotted to it *in principle* in some scientific psychological trend or another. The difference in views here is very great, and it makes itself felt already in a conflict of initial theoretical positions.

One of these positions expresses a theoretical line that stems from Spencer's positivist evolutionism;[1] his ideas had a direct influence in particular on American pragmatic psychology.[2] Underlying this principled position is the as-

[1] See: Herbert Spencer. *First Principles* (Collier, New York, 1901); idem *The Principles of Psychology* (London, 1870).

[2] See: L. P. Thorpe, A. M. Schmuller. *Contemporary Theories of Learning* (Ronald Press, New York, 1954), pp 32-34.

sumption that man, in contrast to animals, and existing not only in a natural but also in a 'supra-organic', i. e. social, milieu, constantly experiences its influences and has to adapt himself to it; it is recognised, moreover, that the laws and mechanisms of this adaptation, and in particular the mechanisms of the acquiring of individual experience, do not change in principle in the transition to man. There is only their complicating through the development of new excitatory factors such as language and social institutions of various kinds. All the basic concepts of biological evolution should consequently be retained in the study of man, viz., concepts of adaptation to the environment and survival; concepts of the integration and differentiation of organs and functions; the concept of two forms of experience—hereditary (species) and individual. In short, there is only a quantitative complication of the processes of adaptation—both species and individual—in the passage from animals to man. Most researchers who take this stand, therefore, in working, for example, on the problem of the mechanisms of man's acquisition of individual experience (learning), usually base themselves unreservedly on the findings of experiments with animals. Although there are, to be sure, certain differences in views of the significance of these findings, they do not touch the essence of the general approach. Thus, while some workers speak directly of the acquisition of individual experience by animals and man as identical (Guthrie[3]), others see the special features of human learning in the fact that it may occur in man on the plane of speech (Skinner[4]); in the extreme case it is assumed that other, special factors intervene during learning in man—of the nature, say, of Wheeler's 'will to learn'.[5]

Decisive importance is ascribed most often to speech, among the factors that 'humanise' behaviour. It is the addition of speech at the human stage (and correspondingly

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[3] See: E. R. Guthrie. *The Psychology of Learning* (Harper & Bros., New York, 1952).

[4] See: B. F. Skinner. *Verbal Behaviour* (Appleton-Century-Crofts, London, 1957).

[5] For a review of current American works on the learning problem see: E. R. Hilgard. *Theories of Learning* (Appleton-Century-Crofts, New York, 1948); L. P. Thorpe and A. M. Schmuller. *Op. cit.*; S. S. Stevens (Ed.). *Handbook of Experimental Psychology* (Wiley & Sons, New York, 1951), pp 517-788.

of systems of speech behaviour, extrinsic and intrinsic) that is considered to explain specifically human aptitudes satisfactorily, viz., the capacity to single out goals; the planning of actions and control of movements. True, as Nuttin has justifiably recalled,[6] Thorndike had already warned, at the dawn of the development of the ideas of behaviourism, against the mechanical addition of speech to animal behaviour in order to explain features inherent in man. Man, he wrote in his early monograph, is just as little an animal to which speech has been added as an elephant is a cow to which a trunk has been added. That, incidentally, did not prevent Thorndike from insisting that man is characterised only by further growth of the same psychic aptitudes as are also characteristic of animals, and that the development of any behaviour generally consists only in the quantitative complexification of the same processes of relationship between the situation and the reaction which are inherent in all vertebrates and even lower animals, beginning at least with lampreys and ending with man.[7]

The same approach, which has remained within the framework of the problem of the organism's adaptation to the environment, is retained in much contemporary work abroad, even in the field of such a specially human problem as that of personality. In it, this approach is expressed in the human personality being regarded as an organism, as the product of an integration of the aggregate of adaptive acts in respect to the physical and in particular the social milieu, as the product of intercorrelations that form an integrated system moulded in the struggle for survival. This approach to personality can be briefly formulated as follows: the subject of study in the psychology of personality is the individual human *organism*; the organism is nothing other than the history of this adaptation.

This approach, which consists in regarding the interrelations of man and society naturalistically, i. e. by analogy with those of the animal and the environment, is one of those that substantiate the pragmatic viewpoint from a theoretical-cognitive aspect.

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[6] See: Joseph Nuttin. *Tâche, réussite et échec* (Publications universitaires, Louvain, 1953).

[7] See: E. L. Thorndike. *Human Learning* (Appleton-Century-Crofts, New York, 1931).

If man's life consists, in fact, in the performance of acts whose sole purpose is survival, then the usefulness of human behaviour and cognition for the subject must be considered its highest justification. From that point of view, success, the positive result (cf. 'The law of effect') becomes the sole criterion of adequacy and correctness: that which leads to success is correct or true. And that is the main thesis of any kind of pragmatism.

Utilitarianism and pragmatism are the *necessary* consequence of a mechanical transfer of biological relationships to the human level; for animals are actually, as it were, 'practical pragmatists', in the sense that there is no other basis for regulating their behaviour than biological usefulness. But they do not have the problems that confront man and mankind.

The naturalistic approach not only leads to the impossibility of explaining the actual specifics of human activity and consciousness scientifically but retrospectively reinforces false conceptions in biology. The return to the animal kingdom from human behaviour, the features of which emerge in this approach as undiscoverable in principle, also inevitably strengthens the idea of the existence of an unknowable principle in biology. This approach in the theory of evolution supports metaphysical, idealistic conceptions—now as though 'from above'—which postulate now a secret 'instinctive' movement of the processes of neurons or the existence of entelechy, now a universal tendency toward 'good form' or deep, perpetually acting drives, etc.

2. The Sociological Trend in Psychology

Psychological work that regards man primarily as a social being and seeks the answers to his inherent mental features in the history of society has a different approach in principle. This work constitutes a sociological, historical trend in psychology, in contrast to the naturalistic, biological trend.

In psychology outside the USSR, this trend is most represented in the French literature. The starting point for work expressing this trend is the principle that human nature

is created by society, and that, therefore, 'society is the explanatory principle for the individual'[8].

The differences here above all concern the interpretation of the development of society itself, which for most foreign authors continues to be idealist. Another important difference stemming from that concerns how the process of 'socialisation' of the individual is interpreted. Authors like Durkheim[9], Halbwachs[10], represent this process, in accordance with their sociological views, as a result of man's spiritual, spoken contact with persons around him, as a result of his mastery of social 'concepts' or 'collective ideas'; society therefore emerges in their work, and that of workers close to them, primarily as its *consciousness*, and the human individual as a 'communicating' or 'associating' rather than a practically active social being. The work that forms this trend has nevertheless made a great, often underestimated contribution to psychology, especially to the problem of the development of logical thinking in connection with the development of language, the origin of higher feelings, and so-called social behaviour, i. e. various kinds of customs, ceremonies, etc. (Janet[11]).

From the standpoint interesting us, Piaget's outstanding research[12] into the child's psychological development has a dual significance, in my opinion. I have in mind, on the one hand, the retention, in his general theory of development, of concepts like organisation, assimilation, and accommodation as basic concepts, and, on the other hand, the thesis of mental development as a product of the development of the individual's relationships with persons around him, with society, which convert and transform the structures of the cognitive processes originally characteristic of the

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[8] G. Dumas. *Traité de psychologie*, Vol. 2 (Alcan, Paris, 1924), p 766.

[9] See: E. Durkheim. *Les règles de méthode sociologique* (Alcan, Paris, 1912).

[10] See: M. Halbwachs. *Les cadres sociaux de la mémoire* (Alcan, Paris, 1925).

[11] See: Pierre Janet. *L'évolution de la mémoire et de la notion du temps* (Chahine, Paris, 1928); idem. *L'évolution psychologique de la personnalité* (Chahine, Paris, 1929).

[12] See: J. Piaget. *The Child's Conception of Number* (Routledge, London, 1952); idem. *The Psychology of Intelligence* (Routledge, London, 1950); idem. *De la logique de l'enfant à la logique de l'adolescent* (PUF, Paris, 1955).

child. He regarded, for example, the most important step in the formation of child logic, viz., the rise of related systems of intellectual operations, as the product of interiorised external collaboration ('cooperation') arising in the conditions of social life. Without cooperation with others, he wrote, the individual could not group his operations into a coherent whole. It is as a result of this duality of Piaget's views that a number of major difficulties arise, one of which finds expression in the social transformation, of which we are speaking, really only emerging at relatively late stages of ontogenetic development and applying only to higher processes.

In the works listed, and in many others concerned with analysing the social, historical nature of man's mental characteristics and aptitudes, there are, it must be noted, undoubtedly progressive, materialist tendencies. These are, (1) the tendency to regard the social in man not in abstraction from his natural features and his neuro-physiological organisation, but rather as a product of the historical transformation of the material, corporeal subject into a unity of its corporeal and psychological properties. This tendency in contemporary French psychology is most clearly represented in the work of Wallon and his school.[13] (2) There is the tendency to overcome abstract, idealist sociologism in study of the history of the human psyche, which is represented by the work of authors who start from a materialist interpretation of society and emphasize the specific, dynamic nature of man's mental activity (Politzer).[14]

No less important is the attempt to introduce the theory of the role of labour into the contemporary historical trend in psychology; labour, by transforming external nature and producing a world of human objects—material and spiritual—at the same time converts the nature of man himself and creates human consciousness (Meyerson).[15]

Both the lines outlined—that of the naturalistic approach to man's psyche and that of the historical or social approach—

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[13] See: Henri Wallon. *De l'acte a la pensée* (Flammarion, Paris, 1942.)

[14] See: Georges Politzer. *Critique de fondements de la psychologie.* 2nd ed. (PUF, Paris, 1967).

[15] See: I. Meyerson. Thêmes nouveaux de psychologie objective: l'histoire, la construction, la structure. *Journal de psychologie normale et pathologique*, 1954, 1/2: 3.

as a matter of fact retain the division of contemporary psychology abroad into two fields, that had been theoretically justified by the Baconian classification of the sciences, which assigned one part of psychology to anatomy and physiology and the other part to sociology. This duality, as we know, was then endlessly reproduced: now in a counterposing of experimental, physiological psychology and theoretical, metaphysical psychology, now in counterposing 'explanatory' psychology and descriptive or 'interpretive' psychology, and now in counterposing behavioural psychology and subjective-phenomenalist psychology.

The mutual isolation in the development of psychological knowledge along these two lines of approach to man's psyche is, of course, only relative, because factual research, although from different positions and different aspects, has progressively penetrated more and more into the same psychological phenomena, which has objectively prepared the possibility of eliminating this duality in psychology. The solution, however, calls for even more theoretical work. Neither mechanist materialism nor idealism can guide psychological research so as to create a single science of man's psychological life. The problem can only be solved on the basis of a philosophical world outlook that extends a scientific, materialist explanation to both natural and social phenomena. And such world outlook is solely the philosophy of dialectical materialism.

3. The Development of the Historical Approach in Soviet Psychology

From the very beginning of its existence Soviet psychology has set itself the task of developing psychological science on the basis of dialectical materialism, on the basis of Marxism. This has also determined its awareness of the decisive, key significance of the problem of the socio-historical conditioning of man's psyche.

Therefore, together with the principle of the mind as the function of a material organ, the brain, that is expressed in the reflection of objective reality, the principle of the role of the social milieu, of the concrete, historical, class condi-

tioning of the psyche was persistently advanced in the first Soviet psychological work.[16]

There is no need to go into detail about the fact that the problem facing Soviet psychologists is one of tremendous complexity and that it can only be solved, even as a first approximation, by long systematic work. Naturally, therefore, the first attempts to construct a Marxist psychology were limited to stating only the most general principles of the materialist interpretation of mind, and criticising militant idealists in psychology[17]. The problem of the social determination of human behaviour was also touched on in the work of that period. Kornilov, for instance, wrote in 1924 when he still held reactological positions: 'We must proceed, not from individual to social psychology, but vice versa' and 'only on the basis of social motive factors will we be able to understand the individual psychology studied by empirical psychology'. He resolutely warned, moreover, against accepting the 'omnipotence of the method of the natural sciences' in psychology.[18] The main methodological problem, however, that of a single approach to study of man's psyche, remained unsolved. This made itself distinctly felt, for example, in the textbook published then by Kornilov,[19] in which a thesis of two factors—the biological and the social—determining man's behaviour was affirmed, and psychological characterisations of members of various social classes in the spirit of Sombart were naively adduced side by side with a description of elementary reactions.

A new step in the development of the problem of the socio-historical conditioning of man's psyche in Soviet psy-

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[16] See: A. A. Smirnov. Forty Years of Soviet Psychology. *Voprosy psikhologii*, 1957, 5.

[17] See: P. P. Blonsky. *Ocherk nauchnoi psikhologii* (An Outline of Scientific Psychology), Moscow, 1921; K. N. Kornilov. *Sovremennaya psikhologiya i marksizm* (Contemporary Psychology and Marxism), Leningrad, 1924.

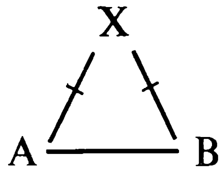
[18] K. N. Kornilov. Psychology and Marxism. In: *Psikhologiya i marksizm* (Moscow, 1925); L. S. Vygotsky. Psychology and the Doctrine of Localisation. In· *Tezisy I-go Vseukrainskogo psikho-nevrologicheskogo s'ezda* (Kharkov, 1924).

[19] See: K. N. Kornilov. *Uchebnik psikhologii, islozhennyi s tochki zreniya dialekticheskogo materializma* (A Textbook of Psychology Presented from the Standpoint of Dialectical Materialism), Leningrad, 1926.

chology was taken in the work of Vygotsky, who was the first in the Soviet Union (1927) to suggest that the historical approach should become the leading principle in the construction of human psychology. He made a theoretical critique of biological, naturalistic conceptions of man, counterposing his own theory of cultural-historical development to them. The most important thing, moreover, was that he introduced the idea of historicism of the nature of the human mind, the idea of the *transformation* of the natural mechanisms of mental processes during socio-historical and ontogenetic development, into concrete, psychological research. He understood this transformation as the necessary result of man's assimilation of the products of human culture during his contact with persons around him.

Vygotsky, we know, based his research on the following two hypotheses: that of the mediated character of man's mental functions; and that of the origin of inner mental processes from originally external, 'interphysiological' activity.

According to the first of these hypotheses, the specifically human characteristics of mind arise as a consequence of previously direct, 'natural' processes being converted into indirect ones through the inclusion of an intermediate link in behaviour ('stimulus—means'). As the result, simple elements were combined into a new 'unit' in the brain. An integrated process developed as in the schematic triangle:



in which A-B symbolises the developed indirect process, while A-X and X-B are elementary connections formed through the closure of ordinary conditioned reflexes. In mediated memory, for example, the elementary associations formed are combined structurally by means of a mnemotechnical sign X; in other cases this role is played by a word.[20]

[20] See: L. S. Vygotsky. The Problem of the Cultural Development of the Child. *The Pedagogical Seminary and Journal of Genetic Psychology*, 1929, *36*, 3: 419-420.

Thus, Vygotsky saw the distinctive nature of man's psychic activity compared with the activity of animals not only in its quantitative complexity, and not only in the objective content reflected by it itself being altered but primarily in a change in its *structure*.

The second hypothesis simultaneously advanced by Vygotsky, according to which the indirect structure of the mental process is originally moulded in conditions in which the intermediate link has the form of an *external* stimulus (and the corresponding process consequently also has an outward form), was also fundamentally important. This hypothesis helped to understand the social origin of the new structure, which does not arise from within and is not invented, but is necessarily formed in intercourse, which is always mediated in man. Thus, for example, the voluntary 'triggering of an action' is originally mediated by an external signal, by means of which another person affects the behaviour of the subject performing the action. At this stage of its formation the indirect structure characterises the corresponding 'interpsychological' process, i.e. the process as a whole in which both the person giving the signal and the one reacting to it by performing the action participate, rather than the process accomplished by the active subject himself. Only afterward, when the triggering signal begins to be produced in a similar situation by the acting subject himself ('self-command'), does the now 'intrapsychological' process, i.e. one wholly performable by a single person, acquire an indirect nature: the elementary structure of a voluntary, volitional act has been created.

In other words, the indirect structure of mental processes always arises on the basis of an individual person's mastery of forms of behaviour that were originally built up as directly social forms of behaviour. The individual, thereby, masters the link ('stimulus--means') which mediates the given process, be it a material means (tool) or socially developed verbal concept or other symbols of some sort. Yet another major principle had thus been introduced into psychology—that the main mechanism of development of man's psyche is one of assimilation of social, historically established types and forms of activity. Because, moreover, activity can occur only in its external manifestation, it was assumed that processes assimilated in their external form were then converted into internal, mental ones.

The ideas put forward by Vygotsky in his day, it must be said, however, by no means represented a complete psychological system. They expressed an approach to the problem rather than its solution.[21]

Another aspect of the principle of the historicism of the human mind consisted in the treatment of the problem of consciousness and activity. The formulation of this problem had its direct source in Marx's teaching on the change of human nature in the course of the development of society's material and spiritual activity. An important milestone in the development of this problem was Rubinstein's article published in 1934 on problems of psychology in the work of Karl Marx.[22] Unfortunately, it did not attract the attention it deserved[23].

Later, basing himself on Marx's famous statement that 'the history of industry and the established *objective* existence of industry are ... the perceptibly existing human psychology',[24] Rubinstein brought out his *Principles of Psychology*, with the proposition that psychology studies the psychological features of activity, and that *'it also includes activity, or behaviour, in its sphere of study'*.[25] He altered this formulation, however, later. In a theoretical paper in 1940 he insisted on the idea that psychology studies 'not the mind *and* activity but the mind *in* activity', and that 'any psychology that understands what it is doing studies the mind and only mind'.[26] Although he repeatedly introduced explanations in subsequent works that prevented these prin-

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[21] A more detailed analysis and evaluation of Vygotsky's work was given by A. N. Leontyev and A. R. Luriya in their introduction to the last edition of his works (L. S. Vygotsky. *Izbrannye psikhologicheskie issledovaniya* (Selected Psychological Research), Izd-vo APN RSFSR, Moscow, 1956.

[22] See: S. L. Rubinstein. Problems of Psychology in the Works of Karl Marx. *Psikhotekhnika*, 1934.

[23] The very fundamental importance of this article has only been noted, so far as I know, in one historical survey, viz., B. M. Teplov's *Sovetskaya psikhologicheskaya nauka za 30 let* (Soviet Psychological Science over 30 Years), Moscow, 1947.

[24] Karl Marx. Economic and Philosophic Manuscripts of 1844. In· Karl Marx and Frederick Engels, *Collected Works*. Vol. 3 (Progress Publishers, Moscow, 1975), p 302.

[25] S.L. Rubinstein. *Osnovy psikhologii* (Principles of Psychology), Uchpedgiz, Moscow, 1935, p 52.

[26] S. L. Rubinstein. Thoughts on Psychology. *Uch. zap. Leningradskogo Ped. Inst. im. Gertsena*, Vol. 34 (Leningrad, 1940)

ciples being interpreted in a simplified way,[27] they have still often been understood in such a way that they have almost completely lost their fundamental sense. They were replaced in essence by another principle, namely, that mental processes are displayed in activity and depend on activity, a position characteristic, for example, of college textbooks of the time.

This position was opposed in the main by the genetic, historical approach to the problem of mental activity, which continued Vygotsky's line in this respect, an approach that found its expression in the view of mental activity as a special form of activity, a product and derivative of the development of material life, of external material activity, which is transformed in the course of socio-historical evolution into inner activity, into the activity of the consciousness; the task of investigating the structure of activity and its interiorisation thereby remained the central problem.

Much less attention was paid to physiological mechanism, it should be noted, in research into the problem of activity, as incidentally in most other psychological works of the 1940s, less, for example, than in Vygotsky's original 'cultural-historical' work. The emphasis on the significance of Pavlov's physiology of the higher nervous activity for psychology that came later therefore posed very serious difficulties for developing the theme of the socio-historical nature of the human psyche, which naturally could not be surmounted right away.

This basic problem of Marxist psychology was relegated, moreover, to second place, so to speak, its treatment being limited chiefly to study of the role of speech (the second signalling system) in behaviour. The general thesis of the historicism, the social essence of man and his consciousness, was thereby retained, of course, but only declaratively and mainly in respect of such psychological problems as that of the social features of personality, higher feelings, moral will, etc.

A double alternative thus arose once more but, as the whole experience of scientific psychology has shown, it was in fact a false one. (1) One alternative was the possibility of psychological investigation 'from the top down', so to

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[27] See S. L. Rubinstein. *Osnovy obshchei psikhologii* (Principles of General Psychology), Uchpedgiz, Moscow, 1948.

speak, from study of the most complex, specially human problems, but here research inevitably, from the very beginning, becomes part of a group of purely descriptive concepts that can be linked with explanatory concepts pertaining to the mechanisms of more elementary processes only at the cost of absolutely arbitrary interpretations.

The second alternative was the possibility of moving 'up from below', from investigation of the simplest relationships and processes analytically or genetically distinguished. If we start from Pavlov's teaching, these are signalling relationships and, correspondingly, processes of the formation of conditioned connections or associations. It is possible thereby, of course, to demand that the researcher not overlook the fact that man is essentially a social being, etc., but this requirement cannot be met in practice for the simple reason that the basic concepts are taken from a system of relationships different in principle from that of man-society relationships. Efforts directed at complicating and enriching these concepts as applied to man, therefore, by introducing, for example, the attribute of activity into the concept of adaptation and the quality of socialness, and class nature as well as activity into the concept of environment (bearing in mind the purposeful, educational effects on individuals), etc., cannot solve the problem in a radical way or lead to an overcoming of the split in psychology. The latter, incidentally, has become so customary that in a comparatively recently published article discussing psychology an attempt was even made theoretically to justify the division of psychological problems into two kinds: into those that are treatable on the basis of Pavlov's teaching and those that are treatable on the basis of historical materialism.[28]

The actual problem is the opposite, of course; it is to apply a single approach to all problems of human psychology and so include them in the system of a single science.

This problem is now, I believe, acquiring especially great importance, because refusal to resolve it is creating conditions for the development of trends in psychology that objectively substantiate naturalistic, positivist conceptions.

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[28] See: A Propos of the Philosophical Problems of Psychology. *Voprosy filosofii*, 1954, 4: 182-193.

4. The Individual and His Environment. Man and Society

There is no need to speak of the real advantages provided by the approach to psychological problems 'from below', from the side of elementary mechanisms, but this approach, as we have seen, encounters serious contradictions.

The main contradiction arises in trying to analyse human behaviour within the context of the classical problem of adaptation, of compensating or counter-balancing the environment. It consists in this, on the one hand, that psychological research, proceeding within the context of the problem of the organism's interaction with the environment, yields obviously limited results that are, by virtue of that alone, in fact, inadequate, and on the other hand that we cannot simply ignore this problem—for man is a natural creature and not, of course, withdrawn from interaction with the environment. We therefore cannot pose the question as follows: should we retain this problem in human psychology or discard it? The question must be put otherwise: as one of where the new content of the 'organism-environment' problem lies as regards man, i.e., as one in which the main point becomes the question of the 'man-society' relationship.

As the whole experience of efforts to find a new content for the problem of the organism and the environment adequate to the human level, however, has shown, it is impossible to do this while remaining within the limits of this problem alone. In order to approach it on this new level it is necessary first of all to analyse the problem of the interrelation of the properties of a species and the individuals forming it.

Because the problem of species and individual is not usually posed at all in psychology, we must first touch briefly on its content as a general biological problem.

The simplest, descriptive definition of a species is that it is a group of very closely related beings. The theory of evolution introduced a phylogenetic sense into the understanding of species: it is a stage of development, a reflection of all previous evolution.[29]

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[29] See: Charles Darwin. *The Origin of Species* (John Murray, London, 1886), p 156.

The reality of the existence of a species as a phylogenetic phenomenon consists in the fact that its properties are transmitted by heredity from generation to generation and are reproduced by the individual organisms of a given species. 'If there were no heredity there would be no species. All individuals which we can refer to the same species belong to the species specifically because they are related by a certain sum of properties common to all of them inherited from a common progenitor'.[30]

On the other hand, from the aspect of the organism, the separate organisms (individuals), are, in relation to their species, a reproduction of its properties. This reproduction is a necessary feature common to all organisms, and their nature, too, is expressed in that. The question of the nature of any living creature is thus one of its inherent properties in which the characteristics of its species are expressed. In other words, the nature of the individual is determined by its belonging to a species and is a reflection of the achievements of a certain stage of phylogenetic development.

From this standpoint the organism's ontogenetic development, which occurs during its inter-relationship with the environment, is nothing other than a realisation of its species properties. It is therefore an absolutely invalid abstraction to consider separate organisms' interaction with the environment without regard to their nature; it is very important to stress this point, considering the simplified positions of certain authors. For *what* the environment is for the organism, and *how* this environment behaves for it, depend on the nature of the organism concerned; and those changes that can arise in it ontogenetically, under the influence of the environment, also depend on the nature of the organism. Because of that the succession of generations and movement of phylogenetic development are maintained.

The human individual, like any living creature, also expresses the traits of its own species—the achievements of the development of previous generations—in its inherent characteristics.

When we say that such and such forms of behaviour, speech, consciousness, etc., are specifically inherent in man, we have in mind precisely the characteristics created phy-

[30] V. L. Komarov. *Uchenie o vide u rastenii* (The Theory of Species in Plants), Izd-vo AN SSSR, Moscow, 1944, p 207.

logenetically, during man's development as the species *Homo*, as the human species (*Menschengattung*, Marx).[31]

The problem thus consists in approaching explanation of the specific characteristics of the individual person, his activity and mind, from the aspect of analysis of the relations and connection of these characteristics with the advances of the development of previous generations of people and of society.

It was just from this aspect, of course, that Marx first gave a scientific analysis of the nature of man as a natural and, at the same time, a social being—and this was a discovery which was of the greatest significance for psychology.

5. Man's Biological and Socio-Historical Development

The idea is still quite widespread that man's phylogenetic development is a continuous process governed by the laws of biological evolution. Descriptions of human fossils from the very oldest at first glance, superficially, create a quite convincing picture of progressive morphological changes that have taken place right up to modern man, and will continue in the future with prospects, perhaps, even of a new species, some *Hominum futurorum*, arising.

This idea is linked with a conviction that man's evolution, governed by biological laws, applies to all stages of his phylogenetic development, including that in the conditions of society. It implies that selection and inheritance of biological traits, ensuring further adaptation to the requirements of society, will continue in these conditions.

Modern, progressive palaeanthropology, however, categorically opposes this conception of anthropogenesis and also the crude biologising deductions that inevitably stem from it.

A most important contribution to a scientific theory of anthropogenesis was the theory that man's phylogenetic development forms a series of successive stages, different

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[31] See: Karl Marx. Economic and Philosophic Manuscripts of 1844. In: Karl Marx and Frederick Engels, *Collected Works*, Vol. 3 (Progress Publishers, Moscow, 1975) pp 295-299.

in principle, at which *different* laws operate (Roginsky and Levin[32]).

The first of these stages is one of preparation for the transition to man. It begins in the late Tertiary and continues until the beginning of the Quarternary, at which time *Pithecanthropus* appears. The representatives of this stage—*Australopithecus*—were apes that led a terrestrial and collective mode of life; characteristic of them were an upright gait and a capacity for complicated manual operations, which made it possible to use rough, still unfashioned tools. The complex relationships within the group make it necessary to assume they also had elementary means of communication.

The second stage, that of Pithecanthropus (Proteranthropus), like the Neanderthal (Paleanthropus) stage following it, is one that can be called '*transitional*' to man of the modern type (Neoanthropus).

The qualitative line separating these stages from the preceding preparatory one is that the fashioning of tools and primitive cooperative activity using tools, i.e. rudimentary forms of labour and society, arose among Pithecanthropecines. And that in principle altered the very course of development.

The only laws of development at the stage of Australopithecines were those of biological evolution. They remained in force at the stages of Proteranthropus and Paleanthropus, in which development brought about a whole series of well-known morphological changes, in particular considerable changes in the endocranium, i.e. the cast of the inner surface of the cerebral portion of the skull.[33]

The morphological changes reinforced by heredity that occurred in connection with the development of labour activity and speech communication, i.e. through the effect of social factors, moreover, were also, naturally, governed by biological laws proper. The development of social production itself and of the phenomena to which it gave rise was another matter. In it a sphere of the exclusive operation

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[32] See: Ya. Ya. Roginsky, M. G. Levin. *Osnovy antropologii* (Principles of Anthropology), Moscow, 1955, p 296.

[33] See: Frederick Tilney. *The Brain from Ape to Man*, Vol. 2 (Hoeber, New York, 1928); M. F. Nesturkh. *The Origin of Man* (FLPH, Moscow, 1959).

of quite new and precisely social and socio-historical laws arose.

The individuals who now became the subjects of the social process were therefore governed at the same time by the effect of biological laws (by virtue of which further morphological changes occurred in them called for by the development of production and intercourse) and by the operation of social laws (controlling the development of social production itself). At these transitional stages the manifestation of new social laws lagged behind the still limited level of biological development, in the course of which man proper, *Homo sapiens*, evolved. The further this process went, the more scope there was for the operation of social laws, and the less the rates of man's social development depended on those of his biological evolution.[34]

A second turning point in human phylogenesis occurred with the transition to the stage of Neoanthropus, i.e. the stage of biologically fully-formed man—man of the modern type. This turning point was expressed in man's socio-historical development being completely freed of its earlier dependence on his morphological development. The era of supremacy of social laws alone began.

'On that side of the line, i.e. in developing man, his labour activity had a very close link with his morphological evolution. On this side of the line, i.e. in modern "fully-formed" man, his labour activity proceeds without any relation to his morphological progress.'[35]

With Cromagnon man, i.e. man in the true sense, people thus already had all the morphological attributes necessary for man's further, unlimited socio-historical development, a process that no longer required any changes in his hereditary nature. The actual course of his development over the tens of thousands of years that separate us from the first representatives of *Homo sapiens* was thus as follows: on the one hand, unusual changes in his conditions and mode of life with no equal in significance and proceeding at progressively increasing rates; on the other hand, stability of his morphological species characteristics, whose variation does

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[34] As Roginsky and Levin stress, we are dealing here precisely with *different* laws, operating in different spheres, and not at all with any kind of intermediate, mixed biosocial laws (*op. cit.*, p 316).

[35] *Ibid.*, p 319.

not go beyond the limits of *variants that have no socially essential adaptive significance.*[36]

Does that mean, however, that all phylogenetic development stops at the level of man? That his nature as the representative of his species, once formed, does not change further?

If we accept that, it is also necessary to accept the idea that aptitudes and functions typical of modern man—for example, very fine phonematic hearing, or the capacity for logical thinking, etc.—are all a product of ontogenetic functional changes[37] not depending on the advances of the species' evolution or the development of preceding generations.

The invalidity of such an assumption is obvious.

Communication by means of language, or the capacity to use instruments and tools, is of course also transmitted from generation to generation, and in that sense represents human species attributes. The individual, in whom, for various reasons, attributes of this kind have not been created ontogenetically (cases like that of the famous Caspar Hauser, described from time to time in the literature) cannot be considered representative of the traits of modern man, however little they differ from his morphological characteristics.

Man necessarily realises the advances of his species during ontogenetic development, including advances accumulated during the socio-historical era, but the form in which the latter are accumulated and consolidated differs radically from the biological form of the accumulation and fixation of phylogenetically moulded characteristics. Correspondingly, there is a radical difference as well in the way the advances of mankind's historical development are passed on to separate individuals.

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[36] The reason for the stopping of morphogenesis in man is not, of course, that the laws of biological variation and heredity ceased to operate, but that selection in the struggle for existence did so. 'Study of the struggle for existence,' Timiryazev wrote, 'stops on the threshold of cultural history. All man's rational activity is a single struggle—the struggle for existence' (K. A. Timiryazev. The Historical Method in Biology. *Izbrannye sochineniya*, Vol. 3 (Izd-vo AN SSSR, Moscow, 1949), p 596.

[37] See: A. N. Severtsov. Evolution and Mind. *Sobranie sochinenii*, Vol. 3 (Izd-vo AN SSSR, Moscow-Leningrad, 1947), pp 298-300.

The problem of the inter-relation of the characteristics of the species and the individual at the human level thus remains, but it acquires a quite different content. Let us now analyse the features of this relationship in man.

6. The Problem of Man's Appropriation of Socio-Historical Experience

Throughout its history mankind has been developing great spiritual forces and abilities, and in this respect the thousands of years of social history have done more than the millions of years of biological evolution. These advances have been accumulated and passed on from generation to generation; consequently they must have been consolidated but, as we have seen, in the era of the dominance of social laws they have not been consolidated in the morphological features, in the form of hereditary fixed changes, having been reinforced in a special, namely external ('exoteric') form.

This new form of the accumulation of phylogenetic experience proved possible in man because specifically human activity is productive in nature, unlike the activity of animals. Such, above all, is men's basic activity, namely, their labour activity.

Labour, by realising the production process (in both its forms—material and spiritual) is imprinted in its product. 'What on the side of the worker appeared in the form of unrest (*Unruhe*) now appears, on the side of the product, in the form of being (*Sein*), as a fixed, immobile characteristic'[38] (*ruhende Eigenschaft*).

The conversion of labour from a form of activity into a form of being (or objectivity—*Gegenständlichkeit*) can be regarded from different aspects and in different contexts. It can be considered from the angle of the amount of labour power expended and in relation to the quantity of output produced, abstracting it from the concrete content of the labour. The process can, however, be considered from the aspect of the content of the labour activity itself in its

[38] Karl Marx. *Capital*, Vol. 1. Translated by Ben Fowkes (Progress Publishers, Moscow, 1976), p 176.

relation to the producing individuals, abstracting it from its other aspects and relations. The transformation then appears to us as a process of the embodiment, objectification of man's spiritual forces in the products of their activity, while the history of mankind's material and spiritual culture appears as a process that expresses, in its outward objective form, the advances in the development of the human species' abilities. From this standpoint each step toward perfecting and improving, for example, tools and implements can be regarded as expressing and consolidating a certain degree of development of the psychomotor functions of the human hand, and a complicating of the phonetics of language, as an expression of the development of articulatory abilities and speech hearing, while progress in works of art can be considered an expression of mankind's aesthetic development, and so on. Even in ordinary material industry we are faced under the form of external things with objectified human abilities or man's objectified 'existential or essential' powers (*Wesenskräfte des Menschen*).

It needs to be specially stressed that it is a question here of man's *psychic* abilities, for although the aggregate of abilities that man sets in motion in the labour process, and is impressed on his product, necessarily also includes his physical forces and abilities, yet these only realise in practice the specific aspect of labour activity that expresses its psychological content. Marx therefore spoke of the objective existence of industry as a perceptibly existing *psychology*, and went on to write:

> A *psychology* for which this book, the part of history existing in the most perceptible and accessible form, remains a closed book, cannot become a genuine, comprehensive and *real* science.[39]

This idea of Marx's is often cited in our psychological literature, but a narrow, mainly historical, genetic sense is usually ascribed to it, whereas, in fact, it is of general and, moreover, decisive significance for scientific psychology, which comes out fully when we consider the other side of the process, when we consider it not from the aspect of the *objectification* (*Vergegenständigung*) of human abilities, but from the aspect of their appropriation (*Aneignung*) by individuals.

[39] Karl Marx. Economic and Philosophic Manuscripts of 1844. In: Karl Marx and Frederick Engels. *Collected Works*, Vol. 3 (Progress Publishers, Moscow, 1975), p 303.

In the course of his ontogenetic development,[40] man enters into special, specific relations with the world of objects and phenomena around him that have been created by preceding generations. Their specific character is determined above all by the nature of the objects and phenomena. That is from one aspect. From the other aspect, the specific character of the relations is determined by the conditions in which they have come about.

The real world closest to man that most of all determines his life is the world transformed or created by human activity. This world is not, however, presented directly to the individual as a world of social objects, of objects that embody human abilities moulded during the development of socio-historical practice; in *this* quality it faces each individual person as a task.

Even the most elementary tools, implements, or objects of everyday use that a child first encounters, must be actively discovered by it in their specific quality. In other words, a child must perform practical or cognitive activity in relation to them such as would be *adequate* (though not, of course, identical) to the human activity embodied in them. It is another question how adequate child's activity will be and consequently how fully the meaning of an object or phenomenon will be disclosed to it, *but there must always be this activity.*

That is why, when objects of human material culture are put into a cage with animals, they do not lose any of their physical properties, but cannot exhibit those specific properties that they have for man; they appear only as objects for adaptation and compensation, i.e. objects just become part of the animal's natural environment.

The activity of animals realises acts of adaptation to the environment, but never acts of mastering the advances of phylogenetic evolution. These advances *are given* to the animal in its natural inherited traits, whereas they are *posed* to man in the objective phenomena of the world about him.[41] To realise these advances in his ontogenetic development man must *master* them; only as a result of this

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[40] I have in mind here, and throughout, only the period of post-natal development.

[41] 'Neither nature objectively nor nature subjectively is directly given in a form adequate to the *human* being,' Marx remarked. *Ibid.*, p 303.

always active process can the individual express a truly human nature in himself, i.e. those characteristics and abilities that are the product of man's socio-historical development. And that is possible precisely because these characteristics and abilities acquire an objectified form.

> Only through the objectively unfolded richness of man's essential being (Marx wrote) is the richness of subjective *human* sensibility (a musical ear, an eye for beauty of form—in short, *senses* capable of human gratification, senses affirming themselves as essential powers of *man*) either cultivated or brought into being. For not only the five senses but also the so-called mental senses, the practical senses (will, love, etc.), in a word, *human* sense, the human nature of the senses, comes to be by virtue of *its* nature, by virtue of *humanised* nature. The *forming* of the five senses is a labour of the entire history of the world down to the present.[42]

The spiritual, mental development of individual men is thus the product of a quite special process, that of appropriation, which does not exist at all in animals, just as the opposite process does not exist in them either, viz., that of objectifying their faculties as objective products of their activity.[43]

The difference between this process and that of individual adaptation to the natural environment must be specially stressed because unqualified extension of the concept of adaptation, of compensation with the environment, to man's ontogenetic development has become very nearly generally acceptable. However, application of the concept to man without due analysis only clouds the real picture of his development.

Can we, for instance, treat man's activity in response to his cognitive need in relation to knowledge, objectively existing in verbal form, which has become the stimulus and goal for him, or even simply the condition for attaining his goal, in terms of adaptation or compensation? Man, in satisfying his need for knowledge, may make the corresponding concept *his own* concept, i.e. grasp its significance, but this is not at all like the process of adaptation or compensation proper. 'Adaptation to a concept', 'compensation with a concept' are phrases devoid of any sense.

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[42] *Ibid.*, pp 301-302.

[43] Understandably I am abstracting the case of the display of 'building' instincts, etc. in animals, because they are obviously of another nature.

Matters are no different when the objects of man's relation are material things created by man's activity, e.g. an instrument of labour. For man a tool is not only an object with a certain external shape and certain mechanical properties; he sees it as an object embodying socially developed ways of acting with it, i.e. labour operations. An adequate relation between man and tool is therefore primarily expressed in his appropriating (practically or theoretically—only in their significance) the operations fixed in it, by developing his own human abilities.[44]

Clearly, the same also applies to all other *human* objects.

The fundamental difference between the processes of adaptation in the proper sense of the term and the processes of appropriation and mastering is that the process of biological adaptation is one of *change* of the organism's species characteristics and capabilities and its species behaviour, whereas the process of appropriation or mastering is one that results in the individual's reproduction of historically formed human capacities and functions. That, it can be said, is the process by which man achieves in ontogenetic development what is achieved in animals through heredity, viz., embodiment of the advances of the species' evolution in the characteristics of the individual.

The capacities and functions formed in man in the course of this are psychological new formations in relation to which inherited, innate mechanisms and processes are only the necessary inner (subjective) conditions making their emergence *possible*; they *do not, however, determine* either their composition or their specific quality.

Man's morphological features, for instance, enable him to form auditory capacities, but only the objective existence of language explains the development of *speech* hearing, and the phonetic features of this language the development of the specific qualities of this hearing.

In exactly the same way logical thought is undeducible in principle from congenital processes in man's brain or from the inner laws that govern them. A capacity for logical thought can only result from mastering *logic*, i.e. this ob-

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[44] 'The appropriation of a totality of instruments of production is, for this reason, the development of a totality of capacities in the individuals themselves' (Karl Marx and Frederick Engels. The German Ideology. In: Karl Marx and Frederick Engels, *Collected Works*, Vol. 5 (Progress Publishers, Moscow, 1976), p 87.

jective product of mankind's social practice. Processes of logical thinking cannot form in a person who has lived from early childhood without contact with objective forms embodying human logic, and without intercourse with men, even though he may, on countless occasions, encounter problem situations, adaptation to which would require the formation of just this capacity.

The idea of man standing alone face to face with the world of objects about him, incidentally, is an entirely artificial assumption. In normal circumstances man's relations with this object world are *always* mediated by relations with other persons and society. They form part of intercourse even when man outwardly remains alone, when, for instance, he is occupied with scientific or similar activity.

Intercourse, in its original, outward form as an aspect of men's joint activity, i.e. in the form of 'direct collectivity' or in an inner, interiorised form—is a second necessary, specific precondition for the process of individuals' appropriation of the advances of mankind's historical development. The part played by it in man's ontogenetic development has been studied quite well in psychological research into early childhood.[45]

From the aspect of interest to us the general results of this research can be summed up as follows. Even in infancy a child's practical relations with the human beings around it necessarily form part of its contact with adults—contact that is also, naturally, initially 'practical'.

The subjective precondition for the emergence of these early dealings with people is the prompting in the child of a specific response evoked in it by the person that Figurin and Denisova called the 'animation complex'[46]. The child's

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[45] See: F. I. Fradkina. *Psikhologia igry v rannem detstve* (The Psychology of Play in Early Childhood). Dissertation. Moscow 1950. *Idem.* The Origin of Speech in the Child. *Uch. Zap. Leningrad. Ped. Inst.*, Vol. 12, 1955; T. E. Konnikova. *Nachal'ny etap v razvitii detskoi rechi* (The Initial Stage in the Development of Children's Speech). Candidate's thesis. Leningrad, 1947; R. Ya. Lekhtman-Abramovich and F. I. Fradkina. *Etapy razvitia igry i deistvii s predmetami v rannem detstve* (Stages in the Development of Play and Actions with Objects in Early Childhood), Uchpedgiz, Moscow, 1949.

[46] See: N. L. Figurin and M. P. Denisova. *Etapy razvitia povedenia detey v vozraste ot rozhdenia do odnogo goda* (The Stages of Development of Infants' Behaviour from Birth to One Year), Uchpedgiz, Moscow, 1949.

practical dealings with the people around it are later also differentiated from this complex reaction.

From the very start this intercourse has the structure of a mediated process characteristic of human activity, but in its early, embryonic forms it is mediated by objects, not by words. It arises because, from the outset, the child's relations with surrounding objects are necessarily effected by an adult: the adult presents something to the infant and the infant pulls it; the adult feeds the infant with a spoon; she sets a rattle in motion, and so on. In other words a baby's relations with the world of objects is always initially mediated by an adult's actions.

The other side of these relations is that actions performed by the baby itself relate not only to the object but also to the adult. The baby, by manipulating the object, for instance, by throwing it to the floor, thereby influences the adult who is present; this is the phenomenon that is sometimes called a 'call to the adult for intercourse'.[47] The emergence of an intercourse motive in a child's behaviour is revealed in some of its acts beginning to be reinforced not by the object effect they produce, but by the adult's reaction to this effect. This has been strikingly demonstrated, for instance, by the findings of Fajans who studied nursery-age children's manipulations with objects: when the adult hid from the child's field of view, its actions ceased; when the adult re-appeared they were resumed.[48]

Thus, right in the very first phases of the individual's development, object activity comes to him through his inter-relation with the people about him and *therefore* not only from its material characteristics and biological sense, but also as the world of objects which are gradually revealed to him by human activity, i.e. in their social meaning.

That also forms the initial basis on which language and speech communication are mastered.

Without touching on the new element that speech introduces into psychic development now (thousands of pages

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[47] E. K. Kaverina. *O razvitii rechi detei pervykh dvukh let zhizni* (On the Development of Infants' Speech in the First Two Years of Life), Uchpedgiz, Moscow, 1950.

[48] See: S. Fajans. Die Bedeutung der Entfernung für die Stärke eines Aufforderungscharacters beim Säugling und Kleinkind. *Psychol. Forsch.*, 1933, *17*: 215-267; *idem.* Erfolg, Ausdauer, und Aktivität beim Säugling und Kleinkind. *Psychol. Forsch.*, 1933, *17*: 268-305.

have been written about it), I only want to stress once more that, although language has an enormous, really decisive role, it is not, however, the *demiurge* of the human in man.[49] Language is that in which mankind's socio-historical experience of practice is 'generalised' and transmitted to individual persons; it is also, consequently, a means of communication, a condition for individuals' appropriation of this experience, and at the same time its form of existence in their consciousness.

In other words, the ontogenetic process of the formation of the human psyche is not due to the influence of verbal excitations in themselves, but is the outcome of the specific process of appropriation described, which is determined by *all* the circumstances of the development of individuals' life in society.

The process of appropriation realises the main necessity and chief principle of ontogenetic evolution in man, i.e. reproduction of the historically formal characteristics and capacities of the human species in the characteristics and capacities of the individual, including also the capacity to understand and employ language.

When we speak of the social environment in which man lives, we have given this concept a different meaning to that in biology, i.e. of the conditions to which organism adapts itself. Man's immediate environment is the social group to which he belongs and which constitutes the circle of his direct intercourse. It naturally has some effect or other on him.

Despite capitalist psychological notions of man's ontogenetic development, however, as 'adaptation to the environment', his adaptation to it is not a principle of his development at all. Progress in man's development can consist, on the contrary, in his leaving the limitedness of *his* immediate milieu, and not at all in adaptation to it, which, in those circumstances, would only have impeded the fullest possible expression of the wealth of truly human traits and capacities. That is why to speak of man's adaptation to his social environment is at least ambiguous—in both social and ethical respects.

Development and man's life call, of course, for maintenance of a continuous interaction, metabolism, between

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[49] See: A. N. Leontyev. Training as a Problem of Psychology. *Voprosy psikhologii*, 1957, 1:12.

him and the natural environment which realises the process of his adaptation to nature. Man does not, however, simply adapt himself to the nature about him, but produces the means for his existence. Because of that, man, unlike animals, 'starts, regulates and controls' this process by his activity.[50] The means, capacities, and skills needed to carry out this activity that mediates his relation with nature, he finds, moreover, in society, in the world that is transformed by the socio-historical process. In order to make them *his own* means, *his own* capacities, and *his own* skills he has to enter into relations with people and with objective human reality. The process of his ontogenetic development is also accomplished in the development of these relations. Like the development of animals in their natural environment, man's development has an ecological character (i.e. depends on external conditions), but unlike the evolution of animals it is not adaptive in the proper biological sense of this term.

When, in the conditions of antagonistic class society, the majority of people, who belong to the exploited classes and oppressed nations, are forced to occupy themselves almost exclusively with rough, physical labour, the difficulties associated with that in the development of their higher spiritual capacities are not explained by their 'inadaptability' to higher requirements, but are determined by the place, not dependent on them themselves, that falls to their lot in the system of social relations. This place, by determining their possibilities of appropriating human activity, also determines their possibility of 'adaptation', i.e. the development of their human nature, their human capacities and characteristics.

Throughout the history of class society the embodiment of the advances of mankind's joint activity and of the totality of human capacities in the development of separate individuals has been one-sided and partial. Only abolition of the supremacy of private property and of the antagonistic relations engendered by it will create conditions such as will eliminate the necessity for this one-sidedness of individuals.[51] The conditions will thereby be created in which the main principle of man's ontogenetic development, viz.

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[50] See: Karl Marx. *Capital*, Vol. I, p 173.

[51] See: Karl Marx. Economic and Philosophic Manuscripts of 1844, p 300.

reproduction in the characteristics and capacities of the individual of these all-round ones that have been moulded in the course of the socio-historical process, will have full scope to develop for the first time.

This implies that manifestation of this principle is no longer limited in these conditions by man's practical 'alienation' from the world of human achievements, and that now, for the first time, the mission, the most important purpose, the prime task of any man can be completely realised, namely all-round development of all his capacities.

Study of the concrete laws of the realisation of this mission, of this purpose of man, is also the most important task of scientific psychology in our day.

But what are the immediate conditions and content of this process?

7. The Main Behavioural Mechanisms in the Ontogenetic Development of Animals and Man

In animals two types of jointly operating mechanisms of behaviour are known; namely, (1) congenital, hereditary mechanisms (unconditioned reflexes, instincts), and (2) mechanisms affecting individual adaptation.

An important feature of a species' congenital behaviour is that its evolution is closely associated with the evolution of exosomatic organs (organs that realise the animal's links with the environment) and is, as it were, the functional aspect of their evolution.

Changes in species' behaviour, like all hereditary changes, take place through selection and the summation of slight changes, and are a *very slow* process corresponding to slow changes in the environment; at the same time they are of *fundamental* adaptive significance.[52]

The mechanisms of individual behaviour are a different matter. Their main difference from those of species behaviour is that only the capacity for behaviour is fixed in them that realises individual adaptation, while the behaviour itself is fixed in the mechanisms of species behaviour. Although these mechanisms respond to rapid changes in the

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[52] See: A. N. Severtsov. *Op. cit.*, pp 298-300.

external medium, their evolution is linked as well with very slow hereditary changes but directly only with changes in the brain, the organ with maximum polymorphism of functions.

The *relationship* between these two mechanisms is a matter of central importance in the behaviour of the individual animal.

The enormous experimental data gathered by research on animals indicates that there is almost no hereditary behaviour that is entirely independent of the influence of individual experience. Even animals with marked mechanical instincts adapt their behaviour (despite Fabre's old ideas) to variable elements of the environment.[53]

Things are no different with such innate acts as the pecking of chicks; the experiments of a number of workers who employed a technique in particular of 'deferring' the start of pecking, have shown that a certain period of practice is needed for success in this respect, during which accommodation and co-ordination take place.[54]

Finally, ontogenetic emergence of unconditioned reflex activity in higher mammals depends not only on the period of maturation of the respective nervous mechanisms, but also on the influence of external conditions, as a result of which innate behavioural mechanisms become overlain with conditioned reflexes.[55]

Thus, during an animal's ontogenetic development its hereditary behaviour is adapted and adjusted to variable elements of the environment, but since there are always variable elements in it, there is always individual variability of animals' species behaviour.[56]

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[53] See: E. Rabaud. Art. cit., p. 8; Arnulf Molitor. Neuere Beobachtungen und Versuche mit Grabwespen. *Biol. Zentralblatt*, 1931, *I*, 8: 412; Karl von Frisch. *Bees* (Cornell U.P., Ithaca, N.Y., 1956).

[54] See: J. F. Shepard and F. S. Breed. Maturation and Use in the Development of an Instinct. *J. Animal Behavior*, 1913, 3: 274-285; W. W. Cruze. Maturation and Learning in Chicks. *J. Compar. Psychology*, 1935, *19*, 3: 371-409; V. M. Borovsky. Behaviour of Chicks Raised in an Incubator. In: *Refleksy, instinkty i navyki* (Moscow, 1936).

[55] See: A. D. Slonim. The Ecological Principle in Physiology and Study of Animals' Instinctive Behaviour. In: *Materialy soveshchania po psikhologii* (Moscow, 1957).

[56] See: I. P. Pavlov. Lectures etc. In: *Polnoe sobranie sochinenii*, Vol. 3 (Izd-vo AN SSSR, Moscow-Leningrad, 1951), p 182.

We know, on the other hand, that the forming of animals' individual behaviour depends on the innate species behaviour peculiar to them. Whether it is a matter of a separate conditioned reflex, a chain stereotype of behaviour gradually being established, or an animal's intellectual behaviour, in all cases there has to be an innate, instinctive basis.

In order to understand an animal's individual behaviour, and its possible changes through the influence of external conditions, it is therefore necessary, first of all, to take the fund of innate behaviour peculiar to that species into account. Pavlov wrote in that respect that

> A full list, detailed description, and natural system of all these reflexes (unconditioned reflexes and instincts — ANL) is one of the immediate, most important tasks of the physiology of the nervous system.[57]
>
> Once more I repeat that it is of the highest importance to have a full list and proper systematisation of these reflexes, because all the rest of an organism's nervous activity is built up, as we shall see later, on this basis.[58]

The comparative-psychological and zoopsychological findings agree that the forming of animals' individual behaviour depends directly on the instincts peculiar to them; an animal is capable, for instance, of solving difficult problems if these seem to be within the range of possibility of the behaviour peculiar to its species, but it cannot cope with easier ones that are inadequate or foreign to the natural conditions of its species' life.[59]

Behaviour is also possible in animals, of course, that seems outwardly to have no relation to their instincts. When, however, one traces the process whereby this behaviour is formed, its link with the hereditary innate fund becomes quite obvious. An example is analysis of the behaviour of performing animals. There seems to be no relation to species behaviour when a sea-lion balances a ball, or a fox unrolls a strip of carpet; nevertheless actions are formed precisely from instinctive reactions.[60] Instinctive

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[57] *Ibid.*, p 362.

[58] *Ibid.* Vol. 4 p 28.

[59] J. V. Buytendijk. *Psychologie des animaux* (Payot, Paris, 1928).

[60] See: M. A. Gerd. Analysis of Training Processes. In: *Materialy soveshchania po psihologii* (Moscow, 1957).

behaviour normal to its species is first evoked in the animal, which includes movements needed by the trainer (the stage of direct or indirect 'persuasion'). These latter movements are then fixed by means of unconditioned reinforcement, while movements on the contrary that are superfluous from the trainer's point of view are inhibited and blocked (the 'reinforcing' and 'polishing' stage). The mandatory character of both stages clearly shows that the new behaviour being moulded by the trainer is a direct derivative of the animal's species behaviour and is a result of its adjustment and adaptation to external conditions; its unusual form, however, is due to the extreme artificiality of the conditions created by the trainer. The same also applies to the specially complex behaviour of animals evoked in certain experiments designed to produce an external effect, like Wolfe's with chimpanzees.[61]

There is no need to consider specially, from this point of view, how individual experience is acquired in conditions more normal for animals. It is well known that the differences revealed by research are differences in concrete mechanisms and in the structure of the behavioural processes themselves, and correspondingly in the reflection of the medium that is formed in them and mediates their realisation. Complication of the mechanisms of individual behaviour from elementary conditioned reflexes to the complex intelligent actions of chimpanzees, however, expresses progress in one direction only, that of developing the animals' capacity to realise their innate species behaviour in conditions further and further removed from the species' general conditions of life.

The individual behaviour of animals thus always depends on experience of a dual kind, viz., species experience fixed in the mechanisms of unconditioned-reflex, instinctive behaviour, and individual experience amassed ontogenetically; *the main function performed by the mechanisms that fashion individual experience, moreover, is that of adapting the species behaviour to the variable elements of the external medium.*

It is a different matter in man, for man, unlike animals, has experience of yet another kind, namely, the socio-his-

[61] See: J. B. Wolfe. Effectiveness of Token-Rewards for Chimpanzees. *Comparative Psychological Monographs*, Vol. 12, 1936, pp 1-72.

torical experience he masters in the course of his ontogenetic development.

This is species experience in the sense that it does not mature in the life span of separate individuals, but is the outcome of the development of many generations and is passed on from generation to generation. It is not, however, fixed hereditarily, and that is its root difference from animals' species experience. Although it is acquired during man's ontogenetic development, it nevertheless cannot be identified with individual experience in the proper sense of the word, for it differs from that not only in content, which is obvious, but also in the fundamental mechanism by which it is acquired and appropriated.

The appropriation of socio-historical experience produces a change in the general structure of the processes of behaviour and reflection, forms new modes of behaviour, and gives rise to genuinely new kinds and forms of it. The mechanisms of appropriation therefore have the peculiarity that they are *mechanisms of the forming of mechanisms*. Their investigation presents real difficulties, since they are masked by the general mechanisms of the forming of individual experience.

When an adult first tries to give a baby a drink from a cup, the touch of the liquid evokes unconditioned-reflex movements in the child that strictly correspond to the natural conditions of the act of drinking (cupping the hands as a natural water-holder). The baby's lips push out, forming a pipe, the tongue is advanced, the nostrils contract, and sucking motions are performed. The cup is not yet seen here as an object that determines the way of performing the act of drinking. The baby soon learns, however, to drink properly from the cup, i.e. its movements are reorganised so that the cup is now used appropriately to its purpose. Its rim is pressed down onto the lower lip, the baby's mouth is distended, the tongue takes up a position in which its tip just touches the inner surface of the lower jaw, the nostrils expand, and the liquid flows from the tipped cup into the mouth. A quite new functional motor system arises that performs the act of drinking and incorporates new elements (my own observations—*ANL*).

The forming of this new functional system depends on the objective properties of the object itself, i.e. the cup, which differs from a 'natural water-holder' not only in

being movable, but also in having a thin rim; the baby's use of these properties, however, is not so much determined by them in themselves, as by the actions of the adult who is giving it a drink, who presents the cup to it properly and gradually tilts it; later, when she puts the cup in the baby's hands, she actively guides and corrects its movements the first time. The adult thus *constructs* a new functional motor system in the baby, partly directly by adjusting its movements (those of holding the cup to the mouth and gradually tilting it), and partly by evoking ready-made reflexes in the baby thereby, that belong, however, to other, natural 'reflex assemblies'.

A baby's mastering of such specifically human actions as using a spoon, pusher, etc. proceeds in the same way. At first the object put into its hand is drawn into its system of natural movements; it carries a full spoon to its mouth as if it were handling any other 'non-implemental' natural object, i.e. without considering, for instance, the need to hold the spoon horizontal. Subsequently, once more through an adult's direct intervention, the movements of the baby's hand with the spoon are radically reorganised and are subordinated to the objective logic of using a spoon. The general character of the afferent innervation of these movements changes, and they are elevated to a higher object level; a functional motor system is built up in the baby that is governed by topological relations, i.e. a system of actions of an implement type.[62]

At first glance a similar reorganisation of movements can be observed in some higher animals, but the similarity is only superficial. With apes, for instance, the actions with a stick used to draw bait to themselves are well developed and, as shown by Novoselova's experiments, they produce a characteristic shift of mobility from the proximal to the mainly distal links of the hand. But this kind of act is the product each time of a newly developed adaptation or adjustment of the animal's natural motions to external metric and mechanical relations and, as Köhler pointed out long ago, they do not represent a special *type* of behaviour.[63] In other words, although apes can develop

[62] See: N. A. Bernstein. *O postroenii dvizhenii* (A Propos the Structuring of Movements), Moscow, 1947, p 120.

[63] See: W. Köhler. *The Mentality of Apes.* Translated by Ella Winter (Harcourt, Brace, New York, 1927).

particular actions with simple implements, the principle of implement activity itself is beyond their reach, as is clear, for example, from the characters of the mistakes they make in using 'tools'.

Another aspect of the difference between the 'tool' actions of animals and real ones is that they arise in animals through the influence of objective conditions (obstacles, the presence of a stick in the field of vision, etc.) and the actions of other animals or man do not play a *decisive* part in their formation. They are not built up with the help of others, are not borrowed, and cannot be performed 'by example'.[64]

Animals are capable of imitation, of course, but it does not produce actions of a new type in them. In general, it must be said, the part played by imitation in animals is often incorrectly exaggerated. Many of the reactions where development is often classed as imitation, in fact also arise without involvement of this mechanism. The vocal responses of birds, for instance, can arise without any imitation whatsoever, as was pointed out long ago by Wagner, citing Le-Danteq's observations of hatched birds;[65] this fact was later rigorously established experimentally in tests with chicks reared in complete isolation, whose vocal responses were found to differ in no way, quantitatively or qualitatively, from those of control chicks (Schjelderup-Ebbe).[66] It is rather different with nesting birds, but even then only a congenital imitation reflex is displayed.

Imitation in apes presents a more complicated problem,

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[64] The possibility of inducing temporary associations in animals by the technique of 'passive movements' is not, of course, altered by what has been said. Even in apes the experimenter's direct intervention only leads to a connection in the animal between the corresponding movement and the food or orienting reinforcement; the 'writing' on a blackboard, for example, that is developed in apes by this method, enters into a connection with the reinforcement through its kinaesthetic components, and not through its result (E. G. Vatsuro. *Issledovanie vysshei nervnoi deyatel'nosti antropoida* (Investigation of the Higher Nervous Activity of an Ape), Moscow, 1948, p 241.

[65] See: V. A. Wagner. *Biologicheskie osnovania sravnitel'noi psikhologii* (Biological Foundations of Comparative Psychology), Vol. 2 (Moscow, 1913), p 375.

[66] See: T. Schjelderup-Ebbe. Beiträge zur Sozialpsychologie des Haushuhns. *Zeit. Psychol*, 1922, 88: 226-252. Cited from David Katz. *Animals and Men* (Longmans, Green, London, 1937), p 208.

and has given rise to a quite wide-ranging discussion.[67] The main source of disagreement, however, is not the contradictoriness of the facts, but what various writers read into the concept of imitation itself.[68]

In any case it can be regarded as established that the capacity of even these 'imitative' animals for imitation and, the main point, the part it plays in their behaviour are extremely limited, as has been shown by the findings of research into imitation not only in monkeys,[69] but also in apes.[70]

In this respect the facts of imitation in the young chimpanzee Johnny, described by Ladygina-Kots, are instructive. Johnny often imitated man's actions, in particular, ones with tools, such as driving a nail with a hammer, nevertheless he did not grasp the objective logic of the action, for sometimes he did not apply enough force, at other times the nail was not held upright, and sometimes he hammered beside the nail. 'In spite of his great practice Johnny thus did not drive in a single nail,' Ladygina-Kots recorded.[71]

Imitation has a fundamentally different character in a baby. Although the phenomenon of reflex imitation is observed in children that is akin to exokinesis, exomimesis or exolalia, in normal cases, however, this has lost its importance by the age of two; at the same time specifically human forms of imitation begin to arise, so-called intelligent imitation, imitation 'of a presented example'. The higher forms of imitation that take shape during children's life have been well studied by Guillaume[72] and

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[67] See: G. Z. Roginsky. *Navyki i zachatki intellektual'nykh deistvii u antropoidov shimpanze* (Habits and Rudiments of Intelligent Actions in Chimpanzees), Leningrad, 1948, pp 175—185.

[68] See: N. J. Voitonis. *Predystoriya intellecta* (The Prehistory of Intelligence), Moscow, 1949, p 214.

[69] See: J. B. Watson. Imitation in Monkeys. *The Psychological Bulletin*, 1908, *5*, 6: 169-178; N. N. Ladygina-Kots. *Prisposobitel'nye motornye navyki makaki* (Adaptive Motor Habits of Macaques), Moscow, 1929; G. Aranovich and Khotin. Imitation in Chimpanzees. *Novoe v refleksologii i fiziologii nervnoi sistemy*, 1929, 3.

[70] R. M. Yerkes and A. Yerkes. *The Great Apes, A Study of Anthropoid Life* (Milford OUP, London 1929); N. N. Ladygina-Kots. *Ditya shimpanze i ditya cheloveka* (The Young of Chimpanzees and Man), Moscow, 1935.

[71] N. N. Ladygina-Kots. *Op. cit.*, p 226.

[72] See: Paul Guillaume. *L'imitation chez l'enfant* (Alcan, Paris, 1925).

Piaget.[73] As the experiments of Zaporozhets, Polyakova and Kirillova have shown, an important feature of imitative acts according to a presented example is that the role of reinforcement is played in their formation by the coincidence of the action itself with the representation of the example and not some excitation or other acting as a result of their realisation.[74] Because of that imitation acquires a new function: whereas, in animals, it is confined to the framework of already existing possibilities of behaviour, in a child it can pass beyond this context, create new possibilities, and form quite new types of action, which brings children's imitation close to training in its specific forms, a process that differs *qualitatively* from animals' learning.

8. Features of the Shaping of Mental Actions

The initial processes described above of a baby's mastery of specifically human actions clearly reveal their main feature, namely that they occur in contact with people. In the early stages of development, however, this contact has a practical form that limits its scope and functions, because the historically formed content of human experience is crystallised and reinforced in verbal form; mastery of it therefore requires it to be imparted and assimilated in a system of verbal meanings and consequently presupposes the involvement of speech and second-signalling mechanisms. Their formation in the child is a necessary precondition of training in the strict sense, i.e. of a process that has mastery of socially accumulated knowledge in the form of its conscious reflection as its outcome.

In the first stages of mastering speech the word is only a signal for the baby that directs its orientative activity in relation to objects sensuously perceived by it, with the result that the latter are approximated and equated to one another in a definite relation, and simultaneously distinguished from other outwardly similar objects. In other

[73] See: J. Piaget. The Child's Conception of Number (Routledge, London, 1952).

[74] See: A. V. Zaporozhets. *Razvitie proizvol'nykh dvizhenii* (The Development of Voluntary Movements), Moscow, 1958.

words, they are generalised and analysed, but already at a new level, in their refraction through the experience of social practice fixed in the meanings of the corresponding words.

At higher stages of speech development, when a child becomes able to understand and use *coherent* speech, not only do the educational processes acquire a more developed form but their function is complicated and, as it were, 'heightened'. The mastering of knowledge becomes a process that in addition leads to the forming of internal cognitive actions in the child, i.e. mental actions and operations. And that in turn serves as a precondition for grasping concepts in their associations and their motion.

Study of this extremely complex process enables us to discover its specific mechanism, i.e. the mechanism by which external actions are *interiorised.*

The phenomenon of interiorisation has, of course, been described by very many psychologists. Its fundamental significance in development was especially emphasised by Vygotsky. In recent times it has been systematically investigated in the USSR by Halperin,[75] Davydov,[76] Pantina,[77] Talyzina,[78] Elkonin,[79] and others; amongst foreign works reference should be made to the numerous investigations of Piaget and his colleagues.

Without going into the content of all this research and considering the differences there are in the theoretical interpretation of interiorisation, I shall deal simply with the question of its necessity.

The interiorisation of actions, i.e. the gradual conversion of external actions into internal, mental ones, is a process that necessarily takes place in man's ontogenetic develop-

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[75] See: P. J. Halperin. Experience of Study of the Forming of Mental Acts. *Dokl. na soveshchanii po voprosam psikhologii* (Moscow, 1954); *idem.*, The Mental Act as the Basis for the Forming of Thought and Image. *Voprosy psikhologii*, 1957, 6: 58-69.

[76] See: V. V. Davydov. The Formation of an Elementary Concept of Quantity in Children. *Voprosy psikhologii*, 1957, 2: 82-96.

[77] See: N. S. Pantina. The Forming of the Motor Habit of Writing Dependent on the Type of Orientation in Lessons. *Voprosy psikhologii*, 1957, 4.

[78] See: N. F. Talyzina. A Contribution to the Problem of Mastering Elementary Geometric Concepts. In *Materialy soveshchaniya po psikhologii*.

[79] See: D. B. Elkonin. Some Problems of the Psychology of Learning to Read and Write. *Voprosy psikhologii*, 1956, 5.

ment. Its necessity is determined by the central content of a child's development being its appropriation of the achievements of mankind's historical development, including those of human thought and human knowledge. These achievements come to him as external phenomena (objects, verbal concepts, knowledge). Their influence evokes a particular response in the child and a reflection of them arises in it; its first reactions to them, however, correspond only to their immediate physical aspect, and not to their specific qualities; their reflection in the child's head is consequently still also a first-signalling one, not yet refracted in meaning, i.e. not yet refracted through the prism of the generalised experience of social practice. For these phenomena to be reflected in their specific quality, i.e. in their meaning, the child must perform activity in relation to them that is adequate to the human activity that is 'objectified' or embodied in them. As regards spiritual phenomena, for instance, as regards some concept that the child encounters for the first time, it must perform a corresponding mental, thought activity. How, however, does this form of activity take shape in the first place?

Let us first dismiss as obviously inconsistent the naive belief peculiar to the old, idealist psychology, that a child has a capacity, by its very nature, for internal thought processes, that the phenomena affecting it only bring them to life and enrich them with a more and more complex content, and that their development consists in that.

Another possible answer to the problem of the development of a child's inner thought activity starts correctly from the point that this activity is not innate; at the same time, however, it assumes that logical thought processes are formed in a child as the product of its personal, individual experience, i.e. in the same way, in principle, say, as the processes of opening problem boxes, or of taking the shortest route through a complicated maze, are formed in animals. The difference consists simply in thought processes taking shape in a child in connection with the effect on it of phenomena that are of a socio-historical nature, including ones that are linguistic in form. During training a child is faced with these phenomena, which are systematically chosen and presented in their proper connections; as a result, by virtue of repetition and reinforcement of these connections, associations and combinations of asso-

ciations in complex, interlaced chains, are formed, whose actualisation represents nothing else than the course of the corresponding thought process.

This representation of the course of development of a child's thinking, however, though it commands respect by its simplicity, comes up against serious difficulties. It is at variance with the real tempo of a child's mastering of mental actions, for the forming of thought processes through a gradual amassing of connections arising through the effect of teaching material can by its very nature be only a very slow business relying on an immense amount of material. In fact, however, it happens very rapidly with relatively limited material, many times narrower in scope than the minimum necessary for the independent formation of the appropriate connections, and their differentiation and generalisation, in the child. Suffice it to mention, for example, the fact established by Ruzskaya's work that even a pre-school child (under seven) can almost 'from scratch', literally from a few examples, learn to analyse and genaralise geometric figures correctly if a process is actively built up in it of orienting among the shapes of these figures by means of signs that the experimentor, so to speak, puts straight into the child's hands.[80]

A much more important and fundamental difficulty that this representation of the development of thought processes comes up against is that, in itself, the actualisation of associations is by no means identical with the process of mental activity, but is simply a condition and mechanism of its realisation. That is readily seen from the simplest, well-known facts. There is nothing simpler for instance than to form firm associative links in a child of the type $2+3=5$, $3+4=7$, $4+5=9$, etc. Yet, despite the fact that these links can be actualised without difficulty in a child, it is unable, all the same, to *add* the respective quantities regardless of whether the elements of these relations are associated in it with the corresponding visualised discrete quantities. The arithmetical act of additions is not created by these relationships, but is *antecedent* to their formation.

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[80] See: A. G. Ruzskaya. Orientation Exploratory Activity in the Forming of Elementary Generalisations in Children. In: *Problemy orientirovochnogo refleksa i orientirovochno-issledovatel'skaya deyatel'nost'* (Uchpedgiz, Moscow, 1958).

For that very reason, too, teaching to count never begins with learning addition tables. Before a child is given tables it should first have learned to add itself with real objects; this action should then be gradually transformed in the child until it is reduced to the concise form in which it is given in arithmetical expressions of the type $2+3=5$, etc. Only thus will the child acquire the possibility of using addition tables for calculation, i.e. will associations of the type mentioned become operators in its mental addition.

The practical and theoretical unsoundness of naive associationist conceptions of training is the result of missing the main link and main condition in the processes of assimilation: namely, the moulding of the actions that form its real basis and that must always be actively built into the child by those about it, since the child cannot develop them for itself.

We have already seen this in relation to the simplest actions with external objects. At first they are *always* made by the child, either with the direct help of an adult, as, for instance, in the cases described above when an infant is mastering the use of a cup, spoon, etc., or, in other cases, as the result of demonstration by an adult, i.e. as 'actions by example'; or finally by way of a hint or verbal instruction. Then, as they are repeated, they are 'processed' in the child and acquire the property of being adjustable to a wide variation of concrete conditions. This further adaptation already proceeds by the general mechanisms of the formation of individual experience, but only now they ensure adaptation to the variability of the concrete conditions of the historically developed actions mastered by the child, rather than of inherited species behaviour, as in animals.

When it is a matter of the forming of inner, mental acts, i.e. actions corresponding to phenomena of ideas, the process is more complicated. Like the influence of man-made objects themselves, the effect of concepts and knowledge is unable by itself to evoke the appropriate, adequate actions in a child, for it must still master them and that also requires active construction of them by another person; unlike external actions, however, inner ones cannot be *directly* built from outside. When an external action is being instilled, it can be demonstrated to the child, and finally there can be mechanical intervention in its execution, for

example, by holding the child's hand in the required position, by correcting the trajectory of its movement, etc. Inner action, action 'in the head', is another matter. It cannot be demonstrated or be seen; it is impossible to intervene directly in its performance by the child. To build a new mental action in a child, for example the addition referred to above, the action therefore needs to be presented beforehand to the child as an external one. i.e. it needs to be *exteriorised*. It is in this exteriorised form, in the form of a developed external action, that it is initially formed. Only afterwards, as a result of its gradual transformation, viz., generalisation and a specific reduction of its links and a change of the level at which it is performed, is it interiorised, i.e. transformed into an internal act that takes place now entirely within the child's mind.

Thus the mastering of the thought actions that underly individual's appropriation and 'inheritance' of the knowledge and concepts developed by humanity necessarily requires a transition of the subject from the actions developed outside to actions on the verbal plane, and finally a gradual interiorisation of the latter as a result of which they acquire the character of reduced, mental operations, mental acts.

This process does not always have to pass through all these stages, of course, or embrace all the links of a newly assimilated mental action. Previously formed mental operations naturally emerge during the mastering of a new action as ready-made thought capacities that are simply 'set in motion'. This circumstance, incidentally, sometimes also creates the illusion that the interiorising of external actions is only a quite special case observed mainly in the early stages of mental development.

In fact, however, it is a process *necessarily* carried out in man's ontogenetic development. It has a fundamental, key significance for understanding the forming of the human psyche because its main feature is precisely that it does not develop through the display of innate capacities, or by way of adaptation of inherited species behaviour to the variable elements of the environment, but is a product of transmission and assimilation by individuals of the achievements of socio-historical development and the experience of preceding generations. Any creative advance of thought that man subsequently makes independently, is only possible on the basis of mastering this experience.

The theory of mental development, therefore, like the psychology of learning, cannot ignore the profound uniqueness of this process and confine itself to representations of the general mechanisms of the forming of individual experience, which are unable, although they underlie it, to disclose its specific features.

9. The Brain and Man's Psychic Activity

The foregoing analysis has proceeded from the following assumptions: (1) that *new* mental capacity, *new* psychic functions are formed in the course of man's socio-historical development, and (2) that in the era of the dominance of social laws, man's brain does not phylogenetically undergo *essential* morphophysiological changes, and that the achievements of historical development are fixed in the objective (material and ideal) products of human activity and are handed on from generation to generation in that form, and that, in consequence, the psychological neoformations arising during the historical process are reproduced by individual persons through their intravital acquisitions rather than through the effect of biological inheritance.

The juxtaposition of these two assumptions poses a very important problem, viz., that of the brain mechanisms of the mental capacities and functions historically developed in man. This problem is the critical point at which the research of most psychologists of the sociological trend halts, yet it is of the utmost importance in principle, for it is the failure to solve it that causes the division of psychology into social, historical psychology and experimental, scientific psychology.

The difficulty of this problem is that aknowledgement of the socio-historical nature of mental capacities leads to the acceptance, at first glance paradoxical, of their relative independence of the brain's morphological features. In other words, the question arises whether there can be psychic capacities or functions that do not have their own special organs in the proper, morphological, meaning of the word.

This question, incidentally, is by no means new to psychology and has long faced scientific psychologists as the

problem of how any process is caused. When, by analogy with the biological concept of a function as the specific activity of an organ, the concept of *psychic* function was introduced into psychology, the problem acquired a particularly sharp form. The task arose of finding organs that correspond to definite, concrete, psychic functions. Since a simple reference to the brain as the organ of the psyche was clearly altogether inadequate, researchers' efforts were directed to relating the different functions as accurately as possible to different brain structures. Attempts to localise particular higher psychological functions directly in the spirit of naive psychomorphologism, however, of course, proved unjustified, above all as regards the facts.

There was no justification for later attempts to relate psychic functions just as closely to some physiological process or other in the cerebral cortex, attempts that were made because of a completely wrong interpretation of the sense of Pavlov's principle of 'superposing the psychological pattern on the physiological canvas', for it is obvious that there are no psychic processes, and cannot be, such that some are a special function, say, of processes of inhibition and others of excitation, or some are a product of general irradiation, and others of 'elective' irradiation. Even such a physiological concept as that of a process in the second signalling system, applies not only to the speech function proper, but also to all the functions in general at the level of consciousness, i.e. to thinking, to logical memory, cognitive perception, voluntary attention, etc.

At the same time, however, progress in experimental psychological research, especially progress in developing the theory of higher nervous activity, completely prepared the way for the only possible positive answer to this very complicated problem.

By the beginning of the twentieth century extensive experimental and clinical material had already been gathered which indicated that even relatively simple sensory psychic functions were the product of the joint activity of various receptor and effector apparatus. That also made it possible to put forward the general proposition that

> wherever the physiological functions of the central elements acquire a specific signification that is expressed psychologically in a peculiar quality of sense sensation ... the *specific*

> character of such an effect is not based on the elements themselves but on their combination.[81]

It was stressed, moreover, that a uniting of physiological elements like that produced a *new* quality not inherent in the elements themselves.

At the same time, much data also led to another, no less important general conclusion, namely that any combination of elementary physiological elements underlying psychic functions was intravitally developed, 'so that', as Wundt wrote, 'this formation must be ascribed entirely to life influences taking place within the individual's development.'[82]

The idea of the intravital formation and reinforcement of complex connections, whose functioning realised cognitive functions, was first developed from the position of a materialist reflex interpretation of the brain's working by Sechenov, who contributed the fundamentally important proposition that the motor links of reflexes have the decisive role in their formation, i.e. not the associations and images themselves, but their 'motor after-effect'.[83]

The concrete physiological explanation of the formation of the connections of the separate elements in a system of reflexes, however, came much later. I have in mind the mechanism of the formation of functional brain systems discovered by Pavlov.

In his paper 'Analysis of Certain Complex Reflexes in the Dog' (1916), Pavlov had already expressed the idea that a notion simply of the work of the separate centres in the nervous system was not enough in order to understand the physiological basis of complex behaviour, and that allowance had to be made for

> the functional combining of the different sections of the central nervous system by means of a special reiteration of the combinations in order for a definite reflex act to be performed.[84]

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[81] Wilhelm Wundt. *Grundzüge der physiologischen Psychologie*, 6th ed., Vol. 1 (Verlag Engelmann, Leipzig, 1908), p 387.

[82] *Ibid.*, p 389.

[83] I. M. Sechenov. *Izbrannye filosofskie i psikhologicheskie proizvedenia* (Selected Philosophical and Physiological Works), Izd-vo AN SSSR, Moscow, 1947, pp 258, 259, 274, 275.

[84] I. P. Pavlov. Twenty Years' Experience... *Poln. sobr. soch.*, Vol. III, Book 1, p 321.

The experimental development of this general idea—that of forming *functional combinations*—subsequently followed the line mainly of investigating the dynamics of the forming and extinction of systems of connections in response to successive operating complex of artificial excitations. Only in some work on man this idea made the basis for studying the structure of those functions that express general, simple, and in that sense universal psychic capacities, such as, for instance, that of visual perception of objects, or of spatial localisation of audial stimuli.[85]

This research, which demonstrated that formations of this kind were undoubtedly of a conditioned-reflex nature, enabled a wider range of facts to be understood from this point of view, facts whose analysis revealed another important feature of them, i.e. their great strength and stability. It is well known, for example, that the natural optico-motor links that are formed in ontogenesis do not fade even after a long absence of reinforcement; as an illustration of that suffice it to mention the fact that visual images associated with tactile sensations persist for years after a person has become completely blind.[86]

A specific feature of these formations is also that, once they have taken shape, they then go on functioning as a single whole, without in any way displaying their 'composite' nature, so that the psychic processes corresponding to them always have the character of simple, direct acts like those of perceiving distance, for example, estimating relative weight (the Charpentier phenomenon), the grasping of visual relationships (insight), etc.

These features enable the intravital formations to be regarded as a kind of *organ*, whose specific functioning also appears in the form of manifested psychic capacities and functions.[87]

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[85] See: E. N. Sokolov. *Vospriyatie i uslovnyi refleks* (Perception and the Conditioned Reflex), Moscow, 1958; Yu. A. Kulagin. An Attempt at Experimental Investigation of Perception of the Direction of a Ringing Object. *Voprosy psikhologii*,1956, 6.

[86] See: M. I. Zemtsova. *Puti kompensatsii slepoty v protsesse poznavatel'noi i trudovoi deyatel'nosti* (Ways of Compensating Blindness during Cognitive and Labour Activity), Moscow, 1956, pp 203-204.

[87] See: A. N. Leontyev. The Nature and Origin of Man's Psychic Properties and Processes. *Voprosy psikhologii*, 1955, 1; *idem*. A Propos of the Systematic Nature of Psychic Functions. In *Tezisy dokladov filosofskogo fakul'teta Moskovskogo universiteta* (Moscow, 1955).

I must stress that it is quite justified to use the concept 'organ' in this context. More than 30 years ago Ukhtomsky suggested the existence of 'physiological organs of the nervous system', in which connection he wrote:

> The concept 'organ' is usually thought of as something morphologically distinct and constant with constant, static attributes of some sort. It seems to me that this is quite optional, and that it would be characteristic of the spirit of the new science not to see anything obligatory in it.[88]

The functional organs in question are clearly different to such formations as, for instance, the chain conditioned reflexes that underlie so-called mechanical habits, differing from them as regards both their origin and dynamics, and the character of their functioning.

They are not formed through the production of associations that simply 'copy' the sequence of external stimuli, but are the product of the linking of reflexes into an integral system that has a highly generalised and qualitatively special function. The reflexes entering into a new connection with one another are initially relatively independent reactions with developed effector nerve endings and feedback afferentares. As soon as they combine, however, their effector links are inhibited and reduced, and operate as internal, intracentre, brain processes. Although the number of purely peripheral effects does not thereby entirely disappear and they can always be detected by sufficiently delicate research, they lose their independent adaptive effect, however, since they now operate in reduced form, and consequently the possibility of being directly reinforced. Reinforcement or non-reinforcement can now only apply to the effect of the final link of the system being formed; once having arisen, these systems are thus already, thereafter, regulated as a single whole.

An example of the integral systems that underlie functions having the form of elementary psychic capacities is the system of pitch hearing.

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[88] A. A. Ukhtomsky. The Dominant as a Factor in Behaviour. In: *Sobranie sochinenii*, Vol. I (Izd-vo AN SSSR, Leningrad, 1950), p 299.

Pitch hearing became differentiated in man as a special faculty because it was a necessary condition of adequate perception of music, which, like language, is a product of social development. Its main difference from hearing capable of perceiving the finest differences in the phonemes of human speech, is that it isolates the parameter of pitch from sound complexes, i.e. isolates that parameter which plays no direct semantic part in most modern (non-tonal) languages; conversely, it also enables the timbre components that determine the specific qualities of speech sounds to be abstracted.

The experimental study of the structure of pitch hearing made by the writer and his associates Hippenreiter and Ovchinnikova demonstrated that this function was formed ontogenetically. The hearing of pitch can be at different stages of formation, or even altogether absent in individual persons; in this event it is compensated by timbre hearing. At the same time we also showed that the decisive link in the structure of this function was a reciprocal response adequate to the sound parameter perceived, viz. the reaction of intoning (vocalising) the pitch. This link initially had the form of singing aloud, attuned to the pitch of the sound being perceived. Later, on being reduced, it was converted into inner singing, which was involved in the analysing of pitch only by its kinaesthetic channels. As a result the analysis of sounds by pitch and pitch relations took place through a special mechanism of active, inner 'comparation', i. e. a process of comparing and adjusting on the inner field. This mechanism, which is formed during life, and whose existence can only be discovered by objective investigation and is completely hidden to introspection, is the organ proper of hearing pitch. Although it takes shape in ontogenesis and, as the research showed, its forming can be actively controlled, its function in no way differs, at first glance, from the manifestation of elementary innate capacities. But that is only a first impression.

More thorough analysis readily brings out the specific features of this kind of systemic function.

The feature of systemic psychic functions most easily established is that their previous complete reflex structure can always be developed and then its reduced motor links revealed, so that their structure, in some cases at least can be reorganised by, for instance, replacing one link by another.

All that, it goes without saying, is completely excluded in regard to functions that are morphologically fixed, i.e. to innate structures.

Another feature of systemic psychic functions is their own unique dynamics, which is expressed in special reinforcement act; while positive reinforcement of the end effect seems to lead to further compression of the functional system, i.e. to inhibition of an even greater number of its elements, its non-reinforcement, on the other hand, paradoxically causes them to develop and become disinhibited. This dynamics comes out clearly in speech, in telephone conversations for instance. When increasing deterioration of audibility evokes no confirmation of the receipt of information from the person being spoken to, or answers inappropriate to the information transmitted, this automatically leads the speaker to a full development of articulation; as audibility begins to improve again, there is a return to normal rapid speech, in which many of the articulation elements are reduced.

This dynamics has been demonstrated experimentally on Napalkov and Bobneva's model for forming multi-link reactions. It appears to be explained by the inhibition of the last operative link of the system inducing excitation (on Voronin's principle of effector generalisation) of the system's previously inhibited links. It can be supposed that the same dynamics also underlies the forming of the functional systems under consideration: links whose inhibition does not alter the end effect, are reduced and the system contracted; as soon, however, as inhibition spreads to a link, reduction of which alters the end effect so that the link ceases to be reinforced, the inhibited link will be revived again. The process of independent ('spontaneous') formation of these functional systems is thus controlled by a unique 'natural selection' of the minimally necessary elements.

The facts revealed by systemic analysis of man's ontogenetically built-up psychic activities, functions, and capacities, and the facts that characterise their formation, fully accord with contemporary data obtained from pathological material.

I have in mind the numerous data that indicate that a disturbance of processes that sets in after damage to a definite sector of the brain, should be interpreted not as *loss* of the function, but as the decay or disintegration of the cor-

responding functional system, one of whose links has been destroyed.[89]

The question of the localisation of psychic functions, as well, is correspondingly answered, i.e. in the sense that they are not based on the functioning of some isolated group of cortical cells or other, but rather on a complex brain system, whose elements are located in different zones of the brain often far apart, but which, however, form a single constellation.

Facts that point to the *chronogeneous character* of the localisation of functional systems, i.e. to the dependence of a pathological effect on the age of the child in whom the damage has occurred, are specially important from the ontogenetic standpoint.

The principle of chronogeneous localisation, the psychological significance of which was specially stressed by Vygotsky,[90] provides yet other grounds for regarding these functional systems as intravital formations with a different inner structure at different stages of development.

Systemic psychological analysis of functions deranged as a result of focal damage to the brain is not only of theoretical importance, but is also of great practical value, by providing a method for effectively restoring them. The method consists in replacing the lost link, after having first developed the structure of the damaged function, by another, intact link and later again 'reducing' the structure, gradually making the corresponding process automatic. An injury to the anterior sectors of the occipital region of the cortex, for instance, can leave the elementary visual functions intact but still cause total inability to read, in which case simple exercise gives no marked restoration of the damage. The defect therefore persists sometimes for years unless special procedures are applied. Ability to read can, however, be quite quickly restored by replacing the optico-motor link of

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[89] See: P. K. Anokhin. General Principles of the Compensation of Disturbed Functions and Their Physiological Substantiation. Doklad na sessii instituta defektologii akademii pedagogicheskikh nauk RSFSR (Moscow, 1953); N. I. Grashchenkov and A. R. Luriya, On the Systemic Localisation of Functions in the Cerebral Cortex, *Nevrologia i psikhiatria*, 1945, 1.

[90] See: L. S. Vygotsky. Psychology and the Theory of Localisation. In *Tezisy 1-go Vseukrainskogo psikhonevrologicheskogo s'ezda* (Kharkov, 1934).

the system by a manual motor link: the patient is re-taught to read by circling the letters presented to him with a sharp pencil, then by 'visual circling'; after a certain time the system with a restructured and now restored link is interiorised and its function assumes the form of normal automatic reading.[91]

For all the peculiarity characteristic of the restoration of functions, compared with their development, both processes express the same systemic structure in an identical way, and it is that which makes both compensation based on substitution of the directly affected element of the function (known as intrasystemic compensation) and the adaptation of functions to new tasks possible; it is no accident therefore that broader significance is now being attached to the concept of compensation since progress in the study of its mechanisms has shown that there is no difference *in principle* between the restructuring of functions in pathological and normal conditions.[92] There is much greater difference in the restructuring of functions because of the functions themselves than between the normal and the pathological. While we can say, for instance, in regard to vegetative and the simplest animal functions, of an immediate, automatically occurring restructuring of them from the organism's 'reserves' under the influence of peripheral impulsion, the restructuring of intravital *psychic* functions is a slow, gradual process involving their exteriorisation and unfolding, and the special development of a new link introduced into their structure and its subsequent interiorisation. In other words, this process occurs through training and is the special 'formal' result of the latter as opposed to its 'material' result expressed in mastering of the teaching material or skills.

Let us return, however, to the more general problem posed. Man's psychic development throughout his social history has thus not caused any morphological changes. The psychological neo-formations arising have had as their brain organs 'functional nervous combinations newly formed through special repetition' that have been reproduced

[91] See: A. R. Luriya, *Vosstanovleniye funktsii mozga posle voennoi travmy* (Recovery of Brain Functions after War Trauma) (Moscow, 1948); *idem*. Psychology and the Problem of the Restructuring of Brain Functions. Izd-vo AN BSSR, 1950, 2.

[92] See: P. K. Anokhin, *Op. cit.*

again and again in people of each succeeding generation as a result of the specific process whereby they assimilate human reality, human being. In that way the change in the highest expression of man's nature—his spiritual capacities and forces—took place.

'Our nature is made'—that applies above all to man's spiritual nature and to the nature of his psyche.

The principal progress in development of the brain made since the coming of modern man has apparently been that the function of fixing the dynamic structures built up has been gradually corticalised, i. e. the role played by subcortical centres in relation to the accumulation of species biological experience has been transferred to the cortex, the organ of ontogenetic experience. And that expresses physiologically what I described above in terms of the possibility peculiar to man of acquiring species experience, i. e. experience of human generations, intravitally.

In that sense progress was prepared by the human brain's whole *prehistory*, during which the functions of its morphologically fixed and functional structures came ever more closely together. Pavlov spoke of this as a 'not very common' point of view yet one he nevertheless 'kept in mind', saying:

> For me construction and dynamics by no means represent the antithesis that is usually supposed. I very often mix them and directly identify them, and for me there is almost no difference.... I also therefore understand that what was earlier dynamic, later becomes constructional, because it is one and the same thing. That is my point of view and I consider that the division between matter and function is arbitrary and relative. Deeper analysis completely wipes out the difference between them and it strikes me as strange when anyone rigidly counterposes construction to dynamics.[93]

While one has to speak, first and foremost, of the formation of hereditarily fixed constructions, these changes are not produced by biological heredity at the level of man but in the process of assimilation described above, which also constitutes the mechanism of social 'inheritance'.

One last question, finally, remains, that of the fundamental relation between the evolution of the brain's physiological dynamics and the development of psychic processes. If

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[93] *Pavlovskie klinicheskie sredy* (Pavlov's Clinical Wednesdays), Vol. 1 (Izd-vo AN SSSR, Moscow-Leningrad, 1954), p 619.

we abstract the individual features that exist in the dynamics of higher nervous activity, it can be taken as essentially invariable, in any case during the history of man's development. Its most general laws that control the brain's activity irrespective of which points of the cortex are thereby associated one with the other and what dynamic patterns are thereby formed also remain just as invariable. The 'patterns' depend on the content of the subject's activity that realises his relations with reality, being governed by the latter's objective properties. The development, variability, and multiformity of this activity creates the development, variability, and multiformity of the patterns, and although they are systems that consist of functional elements entering into connections with one another, and are a product of the brain's work, the qualitative features of their function nevertheless cannot be expressed in terms of physiological concepts. What they reflect is not reproduced in their structure as a geometric shape, for instance, is reproduced in its graphic representation on paper. In their specific attribute, i. e. as systems realising reflection, they are revealed only by being actualised, i. e. only reproducing the subject's activity in relation to the reflected reality in transformed form, because it is the activity that is the real process in which the reflected passes, is 'translated' into the ideal, into reflection.

Man's psyche is thus a function of the higher brain structures that arose in him ontogenetically in the course of his mastering of historically moulded forms of activity in relation to the *human* world about him; that aspect of man's development which is physiologically expressed in the reproduction, change, and complication of these structures in succeeding generations, is also the process of the psyche's historical development.

Experimental study of the genesis and structure of man's psychic capacities and functions, which are formed during their mastering of the achievements of socio-historical development, allied with study of the genesis and structure of the corresponding brain mechanisms, implies that the historical approach is also spreading to areas of boundary, psychophysiological research.

This study has only made its first steps, yet already experience of analysing the systemic structure of capacities like that of hearing brought into being by the objective exis-

tence of man-made world of musical sounds and speech, or the faculty of human perception of colour are furnishing new experimental proof that man's psychic properties, both general and special, are not the development of some special properties biologically innate in him, whose presence or absence can only be ascertained, but that these characteristics are formed in the course of development and upbringing.

This experience indicates that knowledge of the laws of their formation will enable us to control this process consciously and to advance more confidently toward the goal of the fullest possible development of the capacities of all people.

III

THE DEVELOPMENT OF HIGHER FORMS OF MEMORY

1

The transition from primitive, biological forms of memory to its highest, specifically human ones is the result of a long, complex process of cultural and historical development. Man had to master his natural, biological memory, subordinate its activity to the new conditions of his social being, had to recreate it anew, making it *human* memory. This idea of man's creation of his memory is beautifully reflected in the old Greek tragedy:

> And I
> Found Number for them, chief device of all,
> Groupings of letters,
> Memory's handmaid that,
> And Mother of the Muses.[1]

It is noteworthy that the origin of memory is associated in these lines with the origin of such indisputably historical modes of behaviour as counting and writing; we shall see in fact that *modern man's memory is the same product of his cultural, social development as his speech, writing, or counting.*

We already find the first steps toward mastery of their natural memory in very primitive peoples. These are the first attempts to provide for their recall, revival of some trace in their memory by means of a special stimulus, which thus fulfills the function of a *memory aid.* The first

> memories (says Janet) are memories of objects and are used as objects. The man who wants to recall a memory takes something into his hand; he ties a knot in his handkerchief, puts a little pebble into his pocket, takes a piece of paper or a leaf from a tree. These are what we still today call *souvenirs.*[2]

Precisely the same mechanism is discovered in the primitive methods in regard to remembering some message,

[1] Aeschylos. *Prometheus Bound* (Haldeman, Julius Co., Girard, Kans.), p 22.

[2] Pierre Janet. *L'évolution de la mémoire et de la notion du temps* (Chahine, Paris, 1928), p 262.

that we encounter among culturally-backward tribes. Such, in particular, is the function of the 'letter sticks' found among the Australian aborigines. Of all the cultural heritage of the Australian race this stick, together with the boomerang, has excited the greatest disputes as to its intrinsic meaning. To some it seemd indisputable proof of the existence of writing understood by everyone. Others saw in it an associated phenomenon of Australian modes of intercourse devoid of any special significance. Only recently has the true significance of this object been elucidated.

> Letter sticks are notched round sticks, a span or so long, or rectangular wooden tablets, so called because they are given before their setting out to the bearers of a message in the intercourse between persons or tribes living far apart, plus a badge designed to make their service known. The groups of notches are cut by the sender and refer to the information being sent.
>
> But they are not in the least, as many ethnographers have long believed, conventional syllabic or even word signs immediately understandable by the recipient or third persons, but are solely *memory aids* for the messenger. As such they primarily signify only definite persons, other living creatures, objects and their number, and places, occuring in the message concerned. The complete sameness of the notches ... is of no import, since we know that the same signs mean quite different objects for primitive peoples, and even different events. The notches are thus after all nothing else than symbols for the individual cues of the message, which in this simple but ingenious way nevertheless permit them to be retained better than without an aid to memory.[3]

We have given this long quotation because the nature of such memory aids, based on external stimuli, is revealed in an unparalleled manner in the method described. Tremendous impressionability, which is probably also characteristic of these tribes, in itself cannot, of course, guarantee surfacing of the necessary recollection at the very moment the message must be delivered. In order for it to be recalled, the traces held mechanically in memory must enter into a natural connection with the new situation through some common link; and this common link cannot be guaranteed when it has not been created beforehand in the actual process of memorising; finally, the impossibility of a chance omission of some individual part of the memorised material cannot be guaranteed against. What does the aboriginal

[3] Karl Weule. *Vom Kerbstock zum Alphabet. Unformen der Schrift* (Kosmos, Stuttgart, 1915), pp 64-65 (my italics—*ANL*).

Australian messenger do when he has to produce a reliable reproduction of the appropriate message at the necessary moment? By making notches on his stick he artificially, so to speak, creates this necessary common link, connecting the present with some future situation; the notches made will be the intermediate stimulus for him fulfilling the function of a *memory aid* by which he in that way keeps control over his memory. Using Taine's comparison, we might say that the Australian aborigine acts in this case like a billiard player who shoots the ball against the cushion in order to pocket it.

Active adaptation to the future is also such an *indirect* act whose structure is specific precisely to human behaviour. In listening to the message to be delivered the aborigine does not perform his task directly, does not take the direct course dictated by the situation stimulating him, but takes a 'roundabout route' so to speak, first creating a means and instrument for solving it. It is as if, in order to shift a weight, he broke off an appropriate lever instead of applying direct efforts to it. The difference between an instrument of labour and the instrumental aid primitive man fashions for his memory is simply that while the former is always directed at external nature, he masters his own behaviour by means of the latter. This difference, however, is of tremendous fundamental significance.

Just as man's learning to employ tools, which served as a kind of prototype of the last word in 'psychological tools', is the turning point in the history of the evolution of his external organs, so also his mastery of his own behaviour by means of external means is a moment of the greatest significance in the history of the development of his psychological functions. The former, *biological*, type of the development of behaviour is replaced by another type, *historical* development. Just as the use of tools ends the animal's passive adaptation to the environment through adaptation of its own organs to it, and permits man to take the path of adapting the environment to his needs, the use of means that organise his behaviour stops the development of his psychological functions through a direct change in their biological basis, and opens the era of their historical, *social* development. The development of such *mediated, indirect* behaviour did not arise, naturally, outside its connection with previous organic evolution; the use of means

by which man masters his own psychological functions cannot be the result of an act 'of invention' appearing as a *deus ex machina* in the history of the forming of his behaviour. It cannot be explained exclusively simply by the demands that the environment makes on man; because it was already included in the preceding biological forms it can only be understood in connection with the general history of their evolution.

The role that is performed by an artificially organised 'stimulus-aid' in the indirect operation of memory was originally played, by virtue of the natural laws of memory, by some chance stimulus that formed part of a previously impressed situation. It was only necessary to exclude the chance nature of the action of the stimulus, which had prepared it beforehand, in order to ensure its reproduction and so make it voluntary. Such associating stimuli were probably first created in relation to other people; understandably, the process of reproduction in that case remained subjectively direct and natural for the 'recaller', although it can also be regarded as objectively mediated. Only when it is directed to itself does the memory aid impart a new quality to this operation. Mediation of the act of recall thus alters nothing in the biological law of this function; only the *structure* of the operation as a whole is altered. By arranging the appropriate 'stimulus-aid' to ensure reproduction of the impression received we master our memory by mastering its stimulation, i. e. we master it by subordinating it to the proper natural laws.

Initially the stimuli that performed an instrumental function were probably only directed toward organising recall of material that had to be reproduced after a certain time and in a certain situation. Some of the data, however, allow us to think that they very quickly began to serve much more general aims as well, helping to fix all the in any way outstanding events in the life of the tribe in the memory irrespective of the moment this experience was used. From that standpoint the theory advanced by Higgins presents extraordinary interest; he saw the main sense of primitive art in its significance for preserving memories. That ancient art objectively actually performed such a function can hardly be denied; on the other hand, there are facts that indicate that individual works were created specially for that purpose. It is extremely difficult otherwise to ex-

plain, for instance, the depicting of their own military defeats which, as Hirn noted, were often depicted in unembellished form, apparently simply as a constant reminder of threatening dangers and a call for vengeance.[4] The aim of these unique 'monuments in honour of defeats' is thus purely utilitarian. They are not monuments of triumph, created under the influence of emotional fervour, that could subsequently serve only the birth of a legend, but rather 'memoranda', a kind of *aide memoire*, to fix an instructive event in the memory. It was in these memorials that history was first written, and the historical memory of primitive peoples was born. It was only necessary for events, which could already be recorded, to be arranged now in chronological order.

While man, on the one hand, masters his remembering by means of the artificial methods he creates, he also makes efforts, on the other hand, to master the processes of *forgetting*. And in fact, if voluntary remembering is the result of a certain intentional *organisation* of the activity of memory through the creation of social stimuli for it, can we not regard the process of forgetting with such voluntary memory, on the contrary, as the result of *disorganisation*, which could be caused by the destruction of stimulus-aids?

A very interesting example of such intentional disorganisation was adduced by Frazer.[5] Describing the belief of a tribe of Mexican Indians that the finding of a certain species of cactus, which they valued highly because of its intoxicating effect, depended on how 'pure' the gatherers and their women were of sin, he gave the following account of the unique 'oblivionising' ceremonies performed by the members of the tribe.

> Four days after the men have started (on the forty-three days' journey to fetch the cactus) the women gather and confess to Grandfather Fire with what men they have been in love from childhood till now. They may not omit a single one, for if they did so the men would not find a single cactus. So to refresh their memories each one prepares a string with as many knots as she had lovers. This she brings to the temple, and, standing before the fire, she mentions aloud all the men she

[4] See: Yrjö Hirn. *Der Ursprung der Kunst* (Verlag Barth, Leipzig, 1904), p 119.

[5] See: Sir James Frazer. *The Golden Bough* (Macmillan, London, 1925).

has scored on her string, name after name. Having ended her confession she throws the string into the fire, and when the god has consumed it in his pure flame, her sins are forgiven her and she departs in peace....

The cactus-seekers themselves make in like manner a clean breast of all their frailties. For every peccadillo they tie a knot on a string, and after they have 'talked to all the five winds' they deliver the rosary of their sins to the leader, who burns it in the fire.[6]

This Indian tribe seemed to connect forgiveness of sins with purification in a dual operation: in order to recall all their sins at the necessary moment, without forgetting one, an appropriate mnemonic symbol was prepared in advance, namely an artificial, knotted-string stimulus, which helped recall sins in the ceremonial confession. When, however, the desired absolution of sins had been obtained, they became non-existent, so to speak, they had to be consigned to oblivion. Then the second part of the operation began; the stimulus, whose function was to revive memory of the sins committed, was burned and destroyed. So by destroying the cause reviving memories, man tried to master the process of forgetting.

This observation may seem only an ethnographic curiosity, but if we think about the essence of this oblivionising operation, we see that the main oblivionising principle that underlies our own attempts to commit something to oblivion is already part of it in naive form. A change of circumstances, a trip to another city, the destruction of certain articles associated with painful impressions—in short everything usually done when we want to free ourselves from the power of old memories, is built on exactly the same principle of deliberate destruction of stimuli reviving definite traces of some sort of our past experience.

Mankind's first attempts to master its memory and subordinate this natural force contained in man himself to his domination were not, of course, made on the basis of *conscious* utilisation of the laws governing this psychological function. Primitive man might know nothing about the laws of psychology but nevertheless quite correctly used the methods of bringing his behaviour under his control that he found in practice. That is why we often come across an attribution of magical significance to these methods,

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[6] Sir James Frazier. *Op., cit.*, p 24.

as in the example cited above. Only during subsequent development of mediated behaviour was this 'naive psychology' of primitive man gradually overcome, and at the same time did the magical or semi-magical character of his first instrumental psychological operations disappear.

Originally the stimulus-aids by which man organised his memory were very imperfect. They were usually very simple material signs or undifferentiated notches, primitive tallies, or even parts of his own body.[7] Understandably such elementary 'instruments' often could not fulfil their. purpose. Their subsequent improvement consisted in their further differentiation and specialisation. The 'knot letter' of the Peruvians can serve as an example of this further improvement of external mnemonic devices. The signs of this letter (quipu or knots, see Fig. 33) had little resemblance

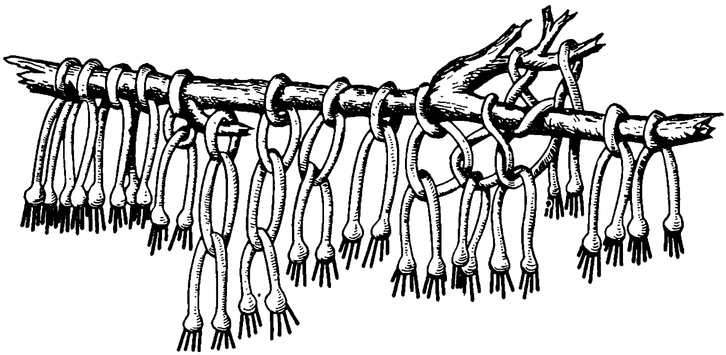

Fig. 33. "Quipu"

to modern written symbols; their main difference was that they did not have a set meaning and therefore needed supplementary oral commentaries by the writer to decipher

[7] We find a very curious example of the use of the fingers as a mnemonic device in Livingstone. Among the nobles of one African tribe (the Wakopaiki) there was a custom, when meeting strangers, to explain their origin to them through their servants. Because their genealogies were communicated in very great detail, the servant reciting that of his master ticked them off on the fingers of both hands (See: David Livingstone. *Exploration dans l'interieur de l'Afrique, Australe et voyages à travers le continent de Saint-Paul de Loanda á l'embouchure du Zambeze, de 1840 à 1856* (Paris, 1859), p 19.

them.[8] The knots were thus only an extremely differentiated conventional memory aid, still in no way differing in principle from the simplest mnemonic signs. At the same time they were a sort of elementary stage in the development of writing in the true sense. By acquiring definite meanings, very conventionally used signs of this kind (knots, drawings, etc.) already form the elements of pictographic writing, which subsequently gives way to even more perfected forms of writing.

The evolution of simplified mnemonic contrivances into written symbols did not happen without trace in memory itself, altering the conditions in which it functions; each new stage in their evolution presupposed new forms of memory. The history of the development of memory, however, cannot be understood simply as that of external fixing signs. The difference between our memory and its natural biological forms is not simply that we have the possibility of using written books or historical documents; both are rather only *substitutes* for its function—shorthand transcripts, photographs or films can even provide recall in victims of amnesia just as surely and accurately as an eiditic's recall. There is another, second line of development of memory that unfolds in parallel with the first, so to speak, and constantly reacts with it.

In resorting to the use of auxiliary aids we thereby alter the fundamental structure of our act of remembering; our previous *direct* remembering becomes *indirect* or *mediated*, relying on two systems, or two kinds of symbol; supplementary 'stimulus-aids' are added to the direct stimuli, which we can call 'stimulus-objects'.

We have seen that these auxiliary stimulus-aids usually take the form of excitation operating from outside—knots, notches cut in a wooden object, etc. Finally they can be some organ of our own body, in which case we already run into some difficulty, for our means of remembering is a very unspecialised one, not *fashioned* specially for the job; it is constantly with us, constantly in our field of perception. With the use of a completely differentiated, spe-

[8] See: E. B. Tylor. *Primitive Culture* (Harper Torchbooks, New York, 1958). The drawing in Fig. 33 is taken from R. Thurnwald's Psychologie des primitiven Menschen. In: *Handbuch der vergleichenden Psychologie*, Vol. 1 (Reinhardt, Munich, 1922), p 245.

cialised aid (e.g. written signs) recall seems to occur independently of our memory as a purely external operation, while, on the contrary, when unspecialised signs are used, it is *mainly* memory that functions, although completely retaining its new structure specifically inherent in mediated remembering. The insufficiently specialised sign, naturally, simply may not perform its function, or may do so badly, but when it is successful the sign's inadequacy necessarily has to be compensated, as it were, by the internal aspect of the operation.

The operation of remembering becomes even more complicated when the functions of the auxiliary aid are performed by some *act* of the memory, i.e. by some process which, although it has its external manifestation, nevertheless takes place in the recalling subject. A host of examples of such remembering could be cited from ordinary life, but in order to maintain objectivity in the exposition we prefer a very simple literary one. One of Gogol's characters, deciding to break his journey for a manuscript he needed, tells us as follows of his efforts not to forget about it.

> Last year (he said) I chanced to pass through Gadyach. I deliberately wound a knot beforehand lest I forget to ask Stepan Ivanovich about it. More, I took a promise of myself to remember about him as soon as I sneeze uptown. All was in vain. I passed the town, sneezed and used my handkerchief, but clearly forgot everything. [9]

Gogol, it is true, made his character suffer fiasco, drawing him on rather comic lines; regardless of that, however, the means to force oneself to remember something by establishing an association with one's own action emerges with extraordinary clarity in this example. What distinguishes this form of the mediation of recall from the methods we described earlier? First of all, in the stimulus-aid, i.e. the appropriate action, being outwardly absent at the moment when the link between it and the object to be remembered is being established, i.e. the link that determines the function of the stimulus. The person doing the remembering only conceived the act that was to be performed, i.e. there was only *an inner trace of his previous experience*. The basic

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[9] N. V. Gogol. Ivan Fedorovich Shponka and His Aunt. *Sobranie sochinenii*, Vol. I (Khudozhestvennaya literatura, Moscow, 1976), p 177.

connection of the material to be remembered is thus established here with some inner element of previous experience which is to fulfil an instrumental function in this act of remembering. The aid-stimulus, which previously operated as an external stimulus, has been replaced by an inner one; the means of recall has been emancipated from its external form as it were.

In our example the final action of the 'stimulus-aid' still occurs on the basis of its effect as an external stumulus, but it is quite natural to suppose that a subsequent transition from 'I must remember this *when I do such-and-such*' to 'I must remember this *when the idea* of such-and-such *comes to me*' is possible. The whole mechanism of higher, logical, volitional memory is already contained in the latter formula.

Such remembering, based on a system of internal stimulus-aids, is a comparatively late stage in the development of memory. In order to make the transition from the use of external stimuli to the use of inner elements of experience, the latter must necessarily be adequately formed and differentiated, in short, the preceding material of memory must be adequately organised. The central role in this shaping of inner experience in man is undoubtedly played by speech; it is in speech that the connections needed for mediated remembering are closed and intentions created. The transition itself from externally mediated memory to remembering that is inwardly mediated, is very closely linked, one may suppose, with the transformation of speech from a purely external function to an inner one.

Apart from the general considerations above that hint at the possibility of our assumption that the inner elements of our experience can perform an instrumental function in behaviour, there are also certain special facts confirming this hypothesis. There is, first of all, the material provided by study of the phenomena of what is called *synopsys*, which consists in the subject producing an inner image of a certain diagram of the arrangement of the impressed material that helps recall it. The phenomena were described in detail by Flournoy[10]; although they are exceptional they are significant because it is their exceptional nature that

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[10] See: L. Flournoy. *Des phénomènes de synopsie* (Paris, 1893). See also G. N. Chelpanov. *O pyamyati i mnemonike* (On Memory and Mnemonics), 2nd ed., St. Petersburg, 1903.

brings out the significance of these inner images for memory with absolute clarity.

The fundamental route followed by the evolution of memory from its lowest, biological forms to its highest, specifically human forms, we depict by the following hypothetical scheme.

Already at the dawn of human culture, we see, natural, biological memory reaches its apogee, but even the outstanding direct impression described in the ethnographic literature is inferior in many ways to the memory of modern man. While our recollections, according to the apt comment of one researcher, *belong* to man, those of the primitive type are only *found* in him. In that sense we can say that man uses his memory but does not rule it.[11] Only in the course of further socialisation of man's psychic processes, which comes about through the effect of the development of higher forms of his social activity, does the turning point in the evolution of memory finally occur that is associated with his resort to auxiliary means to organise his own remembering. It is then that 'man's domination of himself'—domination of his memory based on its subordination to natural laws—begins, and it is from that moment that the history of the development of higher, specifically human memory also begins.

The fact that one and the same action can be evoked by a new stimulus regardless of its starting point creates all memory. Memory also consists in a given act being performable in connection with new stimuli that were not originally part of the situation causing it. The correctness of this proposition of Janet's comes out fully in the light of our conception of higher forms of memory. While the action mechanism of unmediated, direct memory poses the process of reproduction into dependence on the action of a situation analogous or similar in some of its elements to that being remembered, mediated remembering makes our recall voluntary, i.e. independent of the situation. And while the first type of recall mechanism can best be expressed by 'that *reminds* me', the second type is expressed by 'I *recall* that'.

If we turn to cases of Korsakoff's psychosis, we see that

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[11] See: L. S. Vygotsky. *Thought and Language*. Ed. and tr. by E. Haufman and S. Vakar (Wiley, New York, 1962).

such a patients' defect is precisely that active recall is impossible for them; when we present words to a patient that have been read to him prior, he recognises them; by 'pushing' him onto them, we can evoke remembrance of having learned them in him, but he is unable to remember them independently. That is typical not only of Korsakoff's psychosis but also, for example of hysterical amnesia, and in general of all cases in which we are dealing with not too advanced disturbances of *higher* forms of memory.

The form of memory that arises from the use of auxiliary stimulus-aids, for instance, that make our recall voluntary, already includes all the signs that distinguish man's higher memory from his lower, biological memory.

The subsequent development of memory follows two, separate, interconnected lines, so to speak: (a) of the development and perfecting of memory aids retaining the form of stimuli from outside, and (b) of converting these aids into inner ones.

The first line is ultimately that of the development of writing; the outward, mnemonic contrivance, being developed and differentiated, is converted into a written symbol. At the same time its function becomes more and more specialised and acquires new features; in its fully developed form the written symbol already completely negates this function, i.e. the memory with which its birth was associated. This line of development lies outside the field of our study.

The second line is that of the passage from using external memory aids to using internal ones, i.e. the line of development of higher logical memory proper. Like the first line it is directly associated with the general process of mankind's cultural, historical development. The social, cultural medium under whose influence man's higher memory is formed, operates on the other hand in the direction of disruption of its old, biological forms. As one student of memory has put it:

> We cannot measure the harm caused to natural memory by the use of printed books, the practice of writing, the use of a pencil or pen to take notes and, in a general way by all the artifices that not only come to the aid of memory but dispense with the use of it.[12]

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[12] L. Dugas. *La mémoire et l'Oubli* (Flammarion, Paris, 1919), p 164.

Modern man nevertheless has a much more powerful memory than even the natural memory of striking accuracy. His memory, though even weaker in its organic basis than that of the man of primitive culture, is at the same time much better equipped. Just as we are superior to our remote ancestors not in the strength of our skeleton or of our musculature, not in the sharpness of our vision and fineness of our sense of smell, but rather in the means of production and the technical skills we possess, so too are our psychological functions superior to those of primitive man because of the higher forms of organisation historically acquired by them.

We have tried, in our exposition, to avoid constructing any complete theory of the phylogenetic evolution of the higher forms of memory. We have employed several artificially integrated historico-cultural and ethnographic facts simply so as to prepare a working hypothesis for our research on the basis of this concrete material. Its main idea is that in essence the higher memory, which presents itself to us in its most developed forms, is quite different, and even opposite in its very nature, to biological memory, is simply the product of man's new type of psychic development, namely, his cultural, historical development. This social, historical form of memory is just as dissimilar from the basis from which it developed as the oak is dissimilar to the acorn from which it grew. The specific mechanism of this higher memory is its operation as a mediated function, i.e. one based on a double series of stimuli.

These propositions, as we have already remarked, are so far only a hypothesis. The central task of the present experimental research is to substantiate it.

We cannot, naturally, seek complete agreement in the data of our work, based on ontogenetic material, with the scheme of the phylogenetic development of memory that we have provisionally sketched. The modern child develops in a quite different social and cultural environment from that in which primitive man lived; the modes and means of behaviour that form mankind's memory, which it mastered during its cultural development, are not biologically inherited by the child, but *historically*, that is to say they are assimilated under the influence of the social milieu, which thus not only presents itself to him as an object of adap-

tation but at the same time *itself creates the conditions and means for this adaptation.*

In accordance with the central idea underlying our general hypothesis is the method of our experiment. Starting from the point that higher forms of memory develop on the basis of a transition from natural remembering to methods of mediated remembering that consists in being performed with the help of auxiliary stimulus-aids, regardless of whether they are internal or external, we had to exteriorise this process and make it accessible to observation. The 'functional method of double stimulation' developed by Vygotsky and Luria, which is based on the principle of introducing a second series of stimuli (stimulus-aids) into the experimental task, in addition to the main initial stimuli, gave us the possibility of doing so. These stimulus-aids can serve as a 'psychological instrument' for the subject, by which he can solve the given problem.

2

Our first, main experimental investigation of memory was carried out on a mass of differentiated material and included around 1200 subjects. With the exception of 222 students with whom the experiments were made on a group basis, all the remaining subjects were studied in an individual experiment that consisted of four runs each comprising a series of ten words that had to be memorised (except the first run, which consisted of ten meaningless syllables). By this mass investigation we thus obtained 4000 values characterising the memory of our subjects, derived from the more than 65000 data obtained.

Material of such volume naturally could not be obtained quickly enough by a single investigator; the gathering of most of it was therefore entrusted by the psychology laboratory of the Krupskaya Academy of Communist Education to a group of students of the school faculty and so carried out on a group basis with our direct participation in and supervision of the work. This was feasible because the method of our experiments itself, with full, detailed instructions, presented no special difficulties, as it contained no evaluation moments calling for some experience on the part of the experimenter, and the need for variations of any kind

in the conduct of the experiment was excluded. On the other hand the students conducting the experiments already had adequate psychological training, and in addition took advantage of special consultations with us before and during their work.

A positive aspect of this method of gathering experimental data, in addition to the considerable extension of research opportunities (e.g. the opportunity to work with children from the national minorities of remote parts of the USSR), was that it guaranteed maximum objectivity of the data obtained thanks to several workers being involved in gathering the same material, which gave a chance to cross-check. With just that aim in view the students' work was so organised that we could compare the material gathered by different experimenters, including our own findings.

The first trial study, which we carried out on normal and mentally retarded children, consisted of a total of three series of words to be memorised, which we gave to them orally. In the first series we read out words at intervals of around three seconds, and immediately after asked the subjects to repeat them. In the second series the subjects were asked to memorise a set of 20 picture-cards, which were put on the table before them at the beginning of the experiment ('to make it easier to memorise'). In this trial study we did not, as a rule, tell the subjects how to use the cards, with the exception of the experiments with oligophrenic children at the Medical-Pedagogical Clinic of the People's Commissariat of Education.

The picture-cards used were chosen so that their content did not correspond with the words to be memorised.

The third series differed from the second simply in the greater difficulty both of the verbal series and in the set of cards, designed for more complex forms of association with the memorised material.

The experiments of the second and third series normally went as follows: the child, on hearing a word read to it, immediately picked out a card from those in front of it, which could remind it by their content of the appropriate word. Then, after the whole series of words had been read out, the child reproduced it, looking at the pictures it had set aside. At the end of the test the experimenter asked the child why it had picked such and such a card to remind it of a certain word, and how the picture had helped it 're-

member' that word. ('How did you remember the word?', 'Why did you pick this picture so as to remember the word, and not some other one?') Subjects' answers were recorded in the minutes of the test; in the same way the cards chosen by them were recorded, and also their verbal reactions during their choice, and finally, both the correct and incorrect recall of the words that were to be memorised.

The first findings obtained in this way were published in part in a preliminary communication in the spring of 1928.[13] We shall not now touch on the special points of that work, which would call for a number of refinements and additions. We shall have occasion to return to them later and now will simply deal with its more general moments that served as the starting point for our subsequent research. In Table 6, which we reproduce from that paper, we present the values (in arithmetic averages) that characterised mediated remembering in various groups of our subjects.

The first, initial question of our experiments was how far the different groups of subjects were capable of converting their memorising into a mediated act, i.e. how capable they were of making instrumental use of the picture-cards we offered them as second, auxiliary stimulus-aids.

As will be seen from the table, the difference in our subjects' coefficients mainly affected the values of the second and third series; while the coefficients of the first series varied within comparatively narrow limits (not more than 16 per cent), those for remembering with cards fell by more than half depending on age and degree of mental deficiency.

Apart from the unusually high effect of remembering with the help of cards that we obtained with normal school-age subjects, we got a completely opposite picture in some of the other groups; the introduction of an auxiliary aid into the remembering process not only did not facilitate the task, but rather made it more complicated and *caused a lowering* of the corresponding coefficients (children of a Class II auxiliary school and a group of oligophrenic children).

When we look a little closer at the material we obtained from these groups, we easily see that the low coefficients

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[13] See: A. N. Leontyev. Mediated Remembering in Children with Defective or Disease-Impared Intellect. *Voprosy defektologii*, 1928, 4.

Table 6

Group of children	Age	Direct memorising, first series (in absolute values)	Mediated remembering			
			second series		third series	
			absolute values	as a percentage of the coefficient of direct recall	absolute values	as a percentage of the coefficient of direct recall
Pupils of a first category ordinary school (around 50 subjects)	10—12	4.8	4.0	200	10	200
Mentally retarded children from an auxiliary school (23 subjects)	average age 12.5	4.7	8.6	181	8.5	179
ditto (20 subjects)	average age 10.4	4.3	5.0	118	4.5	106
Oligophrenic children from the Medical Pedagogical Clinic (14 subjects)	9–14	4.2	3.8	90	3.9	69

for mediated remembering among them are not to be explained by their being unable to understand the content of the pictures or words, or of establishing an association between them, but depended on the fact that the introduction of the cards did not alter the structure of their acts of memory, which remained direct and unmediated. To run ahead a little, we could say that the children of this group were unable to use a present situation for future purposes.

Our initial data showed quite obviously that a more or less successful choice of picture to memorise a word was not evidence that the child was capable of using the picture as an instrument. *In toto* the process by-passed the picture, which, so to speak, proved to be related to it by association but not included in it. When asked to recall the words a child that was unable to mediate its remembering usually either named words unrelated to the pictures (it would look at a picture and reproduce a word from the given series, but one that did not correspond to

the picture) or just simply named the object depicted on the card. The picture in that case did not help the child but interfered, precisely because it was not involved in the process *together with* the main stimulus but at the same time as it. It could be supposed that the choice of picture for a child who could not recall the appropriate word with the aid of a picture was of a quite chance character, even when the picture was chosen correctly, and the child had not established a link between it and the word. To the question *why* that card had been picked, however, we often got an answer that unquestionably refuted that supposition. One of the subjects, Vera, a very deficient child, for instance picked a card with a picture of an *onion* to remind her of the word *dinner*. The choice, we see, was undoubtedly successful, and the child was capable of establishing a link between card and word. In fact, when we asked why she had picked that card, we got a quite satisfactory answer: 'Because I eat onions'. During the test, however, she could not reproduce the required word at all.

We could adduce a whole series of similar examples, which we shall do a little later. Now we would simply like, as a preliminary, to note the following assumption, which stems from that, namely that a child's capacity to establish elementary associations between a word and a picture is not yet the element solely determining the process of mediated remembering; a child capable of establishing some associative link between them may at the same time prove unable to use the card linked with the word instrumentally; the link for it must obviously still correspond to certain special conditions that communicate an *instrumental* function to the card, i.e. that determine its involvement in the operation as a symbol. In other words, the development of mediated psychological acts, in particular the development of mediated remembering, is a special line of development that does not wholly coincide with the development of elementary associations, although this development is also a necessary condition of it and its fundamental basis. Reverting again to Table 6, we see that, parallel to the steep rise in the coefficients of mediated recall in these groups of our subjects, there is also a slight rise in the coefficients of recall without the aid of cards; the relation between the indices of the first and the second or third series (expressed as percentages in the table), did not remain constant

but rose vigorously with a general increase in the coefficients. When we add to that our data from the experiment with preschool children (under seven) and students, which do not figure in the table, we get the following indices: preschool children (18 subjects)—first series 4.7, second series 4.6; students (46 subjects)—first series 11.8, second series 13.2; and we can formulate the following, second initial assumption on the basis of these preliminary findings, namely that with transition to a higher intellectual level of our subjects (from preschool children to adults, from a high degree of deficiency to normally gifted children) we have a steep rise in the indices of mediated memory (preschool children and subjects of school age); this rise proves to be less steep when we compare the recall of school-age children and students. On the other hand, we must note a certain growth as well in the number of words retained without the use of cards, which yielded a particularly significant increase, on the contrary, when we compared the results obtained with school-age children and those of students. With mentally retarded and preschool children the introduction of pictures into the process as an aid does not increase the effectiveness of their memorising; with school-age children, on the contrary, it increases the number of words they retain to an extraordinary degree, and, finally, with educated adults the difference between the coefficients of both basic series again levels off, but this approximation, this equalisation now occurs at a new, higher level.

This point, established by our preliminary experiments, faced us with two extremely important, inter-related problems that were basic, and at the same time, central, to all the subsequent investigation. First of all, there was the question of whether remembering without aids (first series) and remembering with the aid of pictures (second and third series) were two absolutely different functions, or whether, by only organising the processes differently by means of two different methods, we were still studying a single psychic function in these two forms. In other words, how far was our original idea justified, that by introducing a system of external auxiliary symbols into the memory process we retained the process itself as such and only stimulated our subjects to mediate it, and at the same time made it available to objective study ('exteriorized' it) in this new form of it as an outwardly indirect process. This question, which

naturally arose from analysis of the coefficients of direct and indirect retention of words, between which, at first glance, we were unable to find any correlation could be solved precisely from this very discrepancy between the coefficients. Here we came to the second question posed by our preliminary studies: how could we explain the increase noted in the coefficients of direct memory, which proceeded very slowly, at first, creating a progressively greater difference from coefficients of remembering by means of pictures, and then approaching these latter coefficients quickly, which also show a marked decline in their rate of increase.

Assuming that the remembering of words in our first series was a very simple act of forming traces and reproducing them and, on the other hand, regarding the process of retention in the second and third series as a quite special operation representing only the 'simulation' of memory, we have to admit their completely independent development, i.e. the development of a capacity for retention and development of the operation of recalling words by pictures, which were revealed in the same way in our experiments.

This assumption, however, at least in its general form, was very decisively repudiated by the analysis of the memorising process itself.

Even in the classical studies of empirical psychology, in which the subjects had to learn meaningless material presented to them purely mechanically, it was noted that some subjects could not, all the same, avoid converting their remembering into a complicated activity characterised by the use of various auxiliary devices.

This second type of memory, which was usually designated (Ogden, Ephrussi) as intellectual or ingenious in contrast to the first (sensory or mechanical), in the absence of special artificial limitations, is essentially the *only* type of developed human memory. The latest special study, undertaken by Foucault with the aim of studying the role of memory aids, has shown that all subjects tested mediated their memorising to some extent.[14] Foucault noted, from the indices of the subjects' self-observation, a whole series of tricks they used for remembering, sometimes exceedingly

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[14] See: M. Foucault. Sur la fixation des images. *Journal de psychologie normale et pathologique*, 1924, 6.

complicated, clever constructs. Thus, in regard to memorising the words *plage*, *grêle*, and *robe*, one subject said: 'I thought of a lady walking on the beach /*plage*/; it began to hail /*grêle*/, and ruined her dress /*robe*/.' Another subject memorised the words *golfe*, *tuile*, *bague*, and *chute* by connecting them in the following system: 'I thought of someone who suffered a fall (*chute*) into a bay (*golfe*); he was wearing a ring (*bague*), and had the misfortune (*tuile*) to fall into the bay (*golfe*).' Simpler examples were the following: *thème*—I thought of the Latin and Greek compositions (*thèmes*) my brother wrote; *ville*—I thought of a town (*ville*), of Montpellier; *croûte*—I thought of a crust(*croûte*) of bread. Even when groups of consonants were being memorised, cases were met in which auxiliary aids of a very high type were used. For example, to memorise the letters *f*,*c*, and *v*, one of the subjects created the following scheme: 'I think of *fosse*, which I write *foce* with a *c*, saying that there is a spelling mistake (*vice*)'. In the same way the memorising of numbers was often done in a purely intellectual way by means, for example, of a mental construct of appropriate curves showing the composition of the number (633, 255, 909, 191) and numerical relationships ($721=7\times3=21$), and, finally, by establishing connections with certain dates, etc.[15]

We obtained quite similar indices from questioning students who had done an ordinary psychological memory test about the method they had used to memorise the words given them.

Meumann, in speaking of memory aids, pointed out 'that such secondary memory aids as the formation of meaningful associations are gradually pushed into the background as a rule, in experiments and most subjects begin to memorise mechanically.'[16] This point, however, finds no support in Foucault's study, who came to the diametrically opposite conclusion that, with repetition of experiments, memorising altered toward an *increase* of its 'intellectualisation'.

Our own research, as follows from what is to come, equally most decisively refutes Meumann's idea.

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[15] *Ibid.*, pp 535, 536, 551, 552, 571.

[16] Ernst Meumann. *Ökonomie und Technik des Gedächtnisses* (Klinkhardt, Leipzig, 1920), p 129.

We thus see that in ordinary conditions memory in an adult is not at all an elementary activity.

The most important conclusion to which Foucault came was that the efficiency of memory becomes the greater (the time of memorising becomes shorter) the more developed the subject's perception is, i.e. *the more that aids are used and the higher their type*. It is this point that in our view explains the increase in indices of word memorising noted in the first series with our subjects. Initially, in the very first stages of intellectual development, capacity to mediate memorising is very poorly developed; the introduction of cards into the experiment—the second series of stimulus-aids—hardly altered the efficiency of memorising in the corresponding groups of our subjects. At a higher level of development, however, the use of a card as an external aid considerably extends natural memory boundaries; at the same time, the use of an external aid, which converts direct unmediated memory acts into mediated, instrumental ones, by the same token creates the conditions for using internal memory means, and the efficiency of memorising in the first series of experiments also began to increase, as the result of its gradual transition to mediated memory. In our adult subjects we thus encountered mediated memory in fact in all three series of experiments, with the difference, however, that in the first series memory was based on inner methods, on inner components of experience, whereas these continued to be present in the second and third series in the form of stimuli acting from outside, which imparted a purely external character to memorising techniques.

We should like to emphasise another circumstance in Foucault's work, that he himself, perhaps, was not inclined to pay enough attention to. When comparing the figures presented by him, characterising the memorising of meaningful words and of more difficult, meaningless (artificial) words by different subjects, we note that the difference was least (18.2 and 46.4 per cent) in an adult, a most 'inventive' subject, who showed the highest memory efficiency (K—0.70), and in a child subject, age nine, who took the longest time (1.99) to memorise the words, compared with the others. This tendency for the coefficients of series of different degrees of difficulty to approximate at the lowest and highest levels of development of memorising methods is in complete agreement with the tendency for the indices we observed

in our experiments to converge. It becomes quite understandable, from the standpoint of the conception of the development of memory we have expressed: with a considerable mechanical method of memorising, which we find in subjects with generally low coefficients, the difference in the content of the material memorised is just as immaterial to them in principle as the content of the images reproduced is irrelevant to the eidetic. We say immaterial *in principle*, because we can hardly speak here of *a purely* 'mechanical' mode of memorising; to be more precise, we should express this rather differently—it is immaterial insofar as the subject's memory is mechanical. While memorising in this case likewise cannot be indirect or immaterial when meaningful or meaningless material is imprinted or material is imprinted with or without the use of pictures, it is, conversely, indirect in any conditions with subjects with a highly developed memory, whether by means of pictures or of inner means, when meaningless words, figures or words of one's own language are retained, that is, we should also expect naturally an equalisation of indices here.

The development of memory, as we see, thus does not follow a continuous route of gradual quantitative change; it is a deeply dialectical process presuming transitions from some forms of it to qualitatively different, new forms. To sum up what we have said above, we could represent the development of memory by the following, preliminary scheme. Its first stage is the development of a natural capacity for impression and reproduction. This stage probably ends in preschool age (under seven) in normal cases. The next stage, typical of early school age, is characterised by a change in the structure of memorising, which becomes indirect but occurs with external means playing a predominant role. Mediated memory, in turn, develops along two lines: (a) along that of a development and perfecting of methods of using aids, which continue to be in the form of stimuli acting from outside, and (b) along the line of a transition from external means to inner ones. Such a memory, based on a highly developed capacity for instrumental use of components of experience that are predominantly internal (inner 'symbolic aids'), constitutes the last and highest stage in its development.

We set ourselves a double task in our mass study: (1) to substantiate the hypothesis presented, which is the start-

ing point for all our subsequent work; (2) to solve the problem of what is *the inter-relation of the two lines of development of mediated memory which we have noted.* In bringing out the quantitative aspect of the subject's transition from the use of external stimuli (symbols) as aids to the use of inner stimuli, by studying mediated memory in age-differentiated material, we could, by the same token, approach the formulation of dynamic laws underlying the development of the highest form of memory, memory based on a symbol, that is, mediated memory.

3

The method of our mass study was rather different from that of the first tentative experiments. The formularies for it contained a series of words, increased in number to 15; in addition, we introduced another (the first) series consisting of 10 meaningless syllables.

The experiment itself was conducted in the same way as the first investigation with the difference, however, that the instruction for the third (and fourth) series always indicated the way the picture cards were to be used. ('When I give the word, look at the cards, select one that will help you remember the word and put it aside'). If the experimenter, for one reason or another, altered the form of these instructions, this was noted each time in the appropriate column of the formulary ('instructions'). When naming the words in the third and fourth series, the experimenter recorded (in the 'picture' column) the picture taken by the subject and then immediately gave the next word. The choosing of the picture was sometimes associated with vocal reactions of the subject ('There is none such here', 'I pick this one...', and so on); these also were recorded in the 'speech reactions' column of the record. After the last picture was picked the experimenter took those that the subject had laid aside, arranged them, if they were not in order, in their original sequence and gave them to the subject one after the other, asking him to say the word corresponding to each picture. In their R column of the formulary a +sign denoted quite correct reproduction of the word. Words that were erroneously reproduced or reproduced only approximately correctly were entered in the 'errors in recall' column. In counting

up the material we did not put *Volltreffer* and *Teiltreffer* cases into special groups, but classed such a 'partially correct recall' either among the unreproduced words or, when the difference was only in the form of the word (e.g. 'hands' instead of 'hand' or 'to study' instead of 'study'), among words correctly reproduced. Because meaningless syllables were also given aloud, we worked out the following rule to evaluate the degree of correctness of their reproduction: cases of inaccurate reproduction in which the difference lay only in the final consonant of the syllable, when it was replaced by a related consonant, i.e., *k* by *g*, *b* by *p*, *t* by *d*, etc. (for example, *ruk* instead of *rug*, *bot* instead of *bod*),[17] we treated as positive. We took the number of correctly reproduced terms in a series as the coefficient of memory.

With younger subjects the experiments were usually performed as a game with a certain prize (sweet, pictures), which the child 'won' during the experiment.

Our formularies contained series consisting of the following Russian words: first series (meaningless): *tyam*, *rug*, *zhel*, *bod*, *gishch*, *nyab*, *guk*, *mykh*, *zhin*, *pyar*; second series: *ruka*, *kniga*, *khleb*, *dom*, *luna*, *pol*, *brat'*, *nozh*, *lev*, *mel*, *serp*, *urok*, *sad*, *mylo*, *pero*; third series: *sneg*, *obed*, *les*, *uchen'ye*, *molotok*, *odezhda*, *pole*, *igra*, *ptitsa*, *loshad'*, *urok*, *noch*, *mysh*, *moloko*, *stul*; fourth series: *dozhd'*, *sobraniye*, *pozhar*, *den'*, *draka*, *otryad*, *teatr*, *oshibka*, *sila*, *vstrecha*, *otvet*, *gore*, *prazdnik*, *sosed*, *trud*.[18]

The set of pictures we used in the third and fourth series consisted of 30 coloured cards (5 cm × 5 cm) on which the following were represented:

third series: a couch, a mushroom, a cow, a wash-basin, a table, a spray of strawberries, a penholder, an airplane, a map, a brush, a spade, a rake, a motor car, a tree, a hose, a house, a flower, notebooks, a telegraph pole, a key, bread, a tramcar, a window, a glass, a bed, a carriage, a table lamp, a frame of a picture, field, a cat;

[17] Translator's note: that is to say, inaccuracies of recall that unconsciously followed the devoicing of final consonants inherent in Russian were not treated as errors.

[18] Hand, book, bread, house, moon, floor, to take, knife, lion, chalk sickle, lesson, garden, soap, pen; snow, dinner, forest, study, hammer, clothes, field, game, bird, horse, lesson, night, mouse, milk, chair; rain, meeting (gathering), fire, day, fight, troop, theatre, mistake, strength, meeting (encounter), answer, grief, holiday, neighbour, labour.

fourth series: a towel, a chair, an inkstand, a bicycle, a clock, a globe, a pencil, the sun, a wine glass, a dinner set, a comb, a plate, a mirror, feathers, a tray, a bakery, factory chimneys, a jug, a fence, a dog, a child's trousers, a room, shoes and socks, a penknife, a goose, a street lamp, a horse, a cockerel, a blackboard, and a shirt.

The whole experiment lasted 20 to 30 minutes for each subject, with the exception of those with younger children, which were usually made with minor interruptions and took a little longer.

In order to obtain our 'age section' we investigated preschool subjects, schoolchildren, and adults in individual experiments, dividing our subjects into separate groups as follows: preschool children, 46; school-age children not yet enrolled, 28; first year schoolchildren, 57; second-year schoolchildren, 52; third-year schoolchildren, 44; fourth-year schoolchildren, 51; fifth-year schoolchildren, 46; sixth-year schoolchildren, 51; students, 35. The combined results obtained for all four series of experiments are given in Table 7, in which the values characterising memory in the different groups are presented as arithmetical means (M), medians (M^e)[19] and modes (M^o); the values of the mean error (m) were calculated by the formula $m=\sqrt{\frac{\varepsilon \cdot 2}{n(n-1)}}$; the relative coefficients of increase in efficiency of remembering are also presented in the same way with going over to the use of cards as second symbol stimuli. They were calculated by the formula $K=\frac{R_3-R_2}{R_2}$ where R_2 is the number of words retained in the second series and R_3 is the number retained in the third series.

Even a very superficial analysis of the changes in the indices presented in Table 7 as a function of the age and group of subjects shows convincingly the basic trend in the development of memory that we pointed out above when presenting the results of our first, tentative study. In reviewing the results of the second and third series of experiments (number of words remembered without the aid of pictures and with the aid of pictures), we find that their ratio is not constant, but changes in a certain regular way, as is

[19] (To calculate medians we used the normal formula: $Med=r+\frac{b-a}{2m}$).

Table 7

Series of experiments		Preschool children (4) 3—5	Preschool children (4) 5—6	Children of the first school group: Children of the first and second classes (7—12)	Children of the first school group: Children of the third and fourth classes (10—14)	Children of secondary-school age—pupils of the fifth and sixth classes (12—16)	Adult subjects—students (22—28)
First series	Mo	—	2,0	2,0	2,0	3,0	4,0
	Mc	0,23	1,60	1,70	1,91	3,07	4,05
	M	0,23	1,45	1,80	1,87	3,19	4,43
	m	0,1	0,2	0,1	0,1	0,1	0,3
Second series	Mo	3,0	5,0	6,0	8,0	0,7	9,0
	Mc	2,17	4,83	6,17	7,21	7,62	9,71
	M	2,2	4,70	6,26	7,25	7,88	10,09
	m	0,3	0,3	0,2	0,2	0,2	0,4
Third series	Mo	—	8,0	13,0	14,0	15,0	15,0
	Mc	2,0	8,0	12,07	13,27	13,67	14,7
	M	2,92	8,1	11,41	12,4	13,1	14,28
	m	0,2	0,8	0,3	0,3	0,2	0,2
Fourth series	Mo	—	6,0	9,0	12,0	12,0	14,0
	Mc	0,93	6,0	8,75	11,04	12,36	13,93
	M	1,7	5,8	8,53	10,68	11,94	13,54
	m	0,4	0,9	0,3	0,3	0,2	0,2
Arithmetic mean of the indices of series II and III		2,31	6,95	9,97	11,54	12,82	13,92
Coefficient of relative increase		0,38	0,72	0,82	0,71	0,66	0,42

shown by the coefficients of relative increase given in the table and comes out particularly clearly in Fig. 34, in which the change in the absolute indices of the two series is represented graphically. In younger preschool children the third series is characterised by the value (*a*), which is only comparatively slightly greater than the corresponding figure of the second series; at the same time, however, with the subsequent, quite rapid development of memory, based on external symbols, memory without the aid of cards develops more slowly, and the difference between the indices increases quite quickly (*b*, *c*). Beginning with this group (*c*) (children aged seven to twelve, pupils of the first and second school classes) the indices of both series begin, on the contrary,

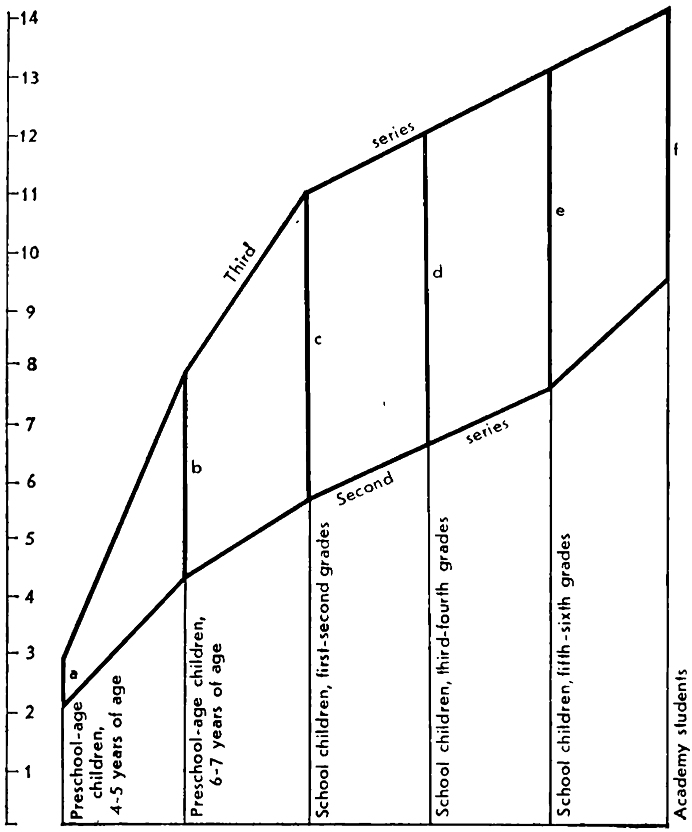

Fig. 34.

to approach one another, and the difference between them increasingly levels off (*d*, *e*, *f*). This can be traced even more distinctly if we simplify somewhat the figure and limit it to a total of three groups: the preschool subjects, the schoolchildren, and the adults (Fig. 35).

The general pattern outlined here might be formulated as follows: with preschool age, the rate of development of remembering with the help of external aids is considerably faster than that of remembering without the aid of cards; on the contrary, beginning with primary schoolchildren, the indices of external direct memory increase more quickly

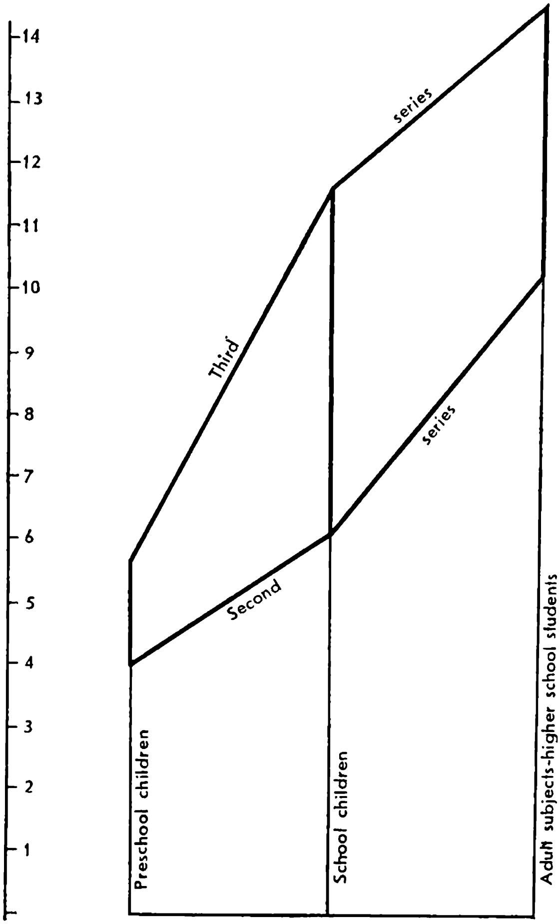

Fig. 35.

than the subsequent increase in mediated memory. In their conventional graphic representation these two lines of development represent two curves that come together at the lower and upper limits, and form a figure whose shape is approximately that of a not quite regular parallelogram with two truncated angles. This is only the form of the distribution of the concrete values of our measurements, inci-

dentally, a form that depends on the group of subjects and the content of the material we presented for memorising. As we shall see below, the curves of these two lines of development can be represented in their *principled* expression precisely in the form of quite regular parallelogram with one of its angles sloping toward the abscissa. In substantiating this principle, however, just as in substantiating any pattern underlying extremely complex phenomena, we encounter a whole series of difficulties that can only be solved by sufficiently detailed analysis.

The concrete content of our findings which let us formulate this pattern existing in the relation between the development of remembering by means of external symbols and the development of externally direct, unmediated memory, in itself does not yet, of course, represent anything to which we would be inclined to ascribe the significance of a theoretical principle. This principle and this pattern only come out in it with more or less precision and clarity, depending on a whole number of the experiment's special conditions: viz., on the nature of the external aids, the degree of difficulty of the different series, etc. The experiment could be so arranged and the groups of subjects so selected that the dynamics of the relations between the indices by series could be traced quite fully or only partially in some single small segment; the graphic form of expression of the relationship could be more or less flexible, but the pattern underlying it remains constant; it was equally detectable both in our preliminary experiments and in the present study, and in the investigation of memory in adults of various cultural standards reported below, in study of the development of mediated attention, and finally in a protracted study of the development of memory in individual subjects. What showed up only as a trend on our graphs became an experimental fact in other experimental conditions or even with a different grouping of the subjects.

In Fig. 35, the bottom and top angles of the figure formed by the development curves are cut off, so to speak, i.e. the curves do not meet; if, however, we divide the group of preschool subjects into smaller groups (about 13 in each), we can already trace their coming together. This is represented graphically in absolute terms in Fig.36.

It is rather more difficult to show the convergence of the curves at their upper limit. The conditions of the experiment

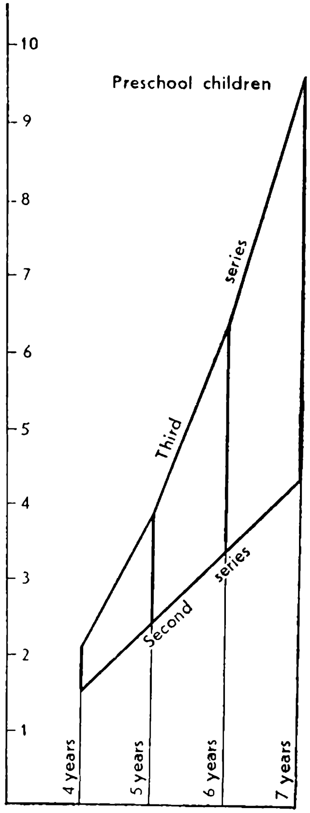

Fig. 36.

for each series of tests confronted subjects with tasks of a certain degree of difficulty, depending both on the content and the number of words to be memorised. It is difficult, however, for practical purposes, to find a degree of difficulty that would be adequate to the experimental purposes in a study of subjects of quite different ages and quite different psychological capacity; at the same time, we were unable to measure the degree of difficulty of the problems we were solving with sufficient accuracy to find the appropriate correction factors that would make it possible directly to compare the data of experiments carried out with different formularies. On the other hand, it is this relation of the indices to the degree of difficulty of the problem that enables us to further argue the principle we have expressed. If the dynamics of the concrete values characterising the development of memory that we have noted does not represent a random relationship between them but is actually an expression of a certain inner pattern of development, any change in the degree of difficulty of the problem that the experimenter sets subjects should produce a quite regular change in the indices. Thus, by complicating the series with external memory aids, we should, reasoning theoretically, expect a drop of the whole series of its indices toward the middle line of development, i.e. in a direction *perpendicular* to the length of the diagonal of our theoretical parallelogram, which would be expressed in a convergence of the curves composing it and would, at the same time, shift the points

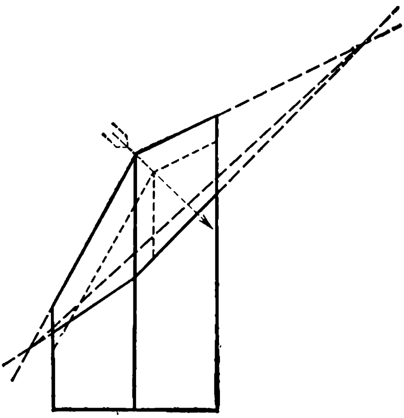

Fig. 37.

at which they are furthest apart to right of the centre of the coordinates (Fig. 37).

In fact, if we turn to consideration of the indices of our more difficult, fourth series, it turns out that their values are in quite exact agreement with our idea.

As will be seen from Fig. 38, in which the coefficients of relative increase calculated with respect to the third and fourth series are represented graphically, the coefficients of the fourth series are much lower, and their general shift moves precisely in the direction suggested. In our youngest group of subjects we have a negative coefficient for this series, i.e. the curves of the indices of the second and fourth series intersect; at the same time their moment of greatest divergence does not fall within the 7-12 age group but passes to an older group of subjects (aged 12-16). The coefficient of memory increase also fell in adult subjects, being expressed by a value of 0.34 (against 0.42 for the third series), which points to a further convergence of the curves at their upper limit. This convergence is even more pronounced with greater complication of the series with externally mediated remembering; thus, in our group experiments, which were carried out with students according to other formularies, the coefficient of relative increase was 0.25. Finally, we can change the conditions of the experiment in a rather different direction and, in that way, come close to almost complete realisation of the tendency indicated.

If we simplify the task simultaneously in all series, preserving their relative difficulty, obviously a shift of the curves of the indices will also occur in these conditions but now direct toward the abscissa, that is, the even more marked convergence of the curves at the upper limit that we actually also had in our preliminary investigation, in which the coefficients of increase among students was expressed as an insignificant 0.12. It is easily

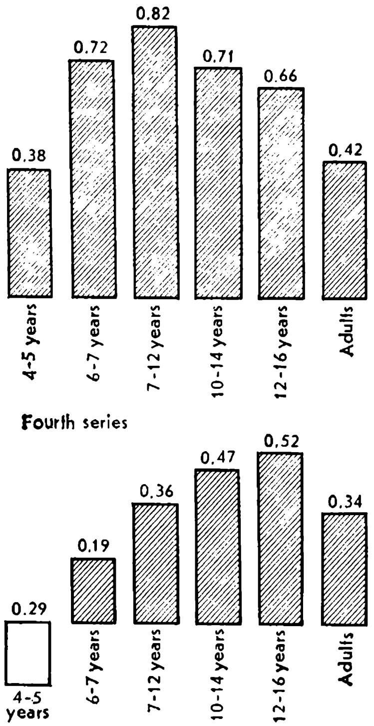

Fig. 38.

understandable that, with greater simplification of the task, for example, by reducing the number of words in a series to ten, we will get a coefficient of zero with our older subjects, i.e. we will have actual equality between their indices in both series.

Before finally formulating our results we would like to touch on another problem here which, although it is of a rather narrow methodic nature, may nevertheless be shown to deserve attention. The point is that, by limiting a memorising series to a total of 15 words, we thereby artificially limit, so to speak, the very possibility of a further increase in the indices of external mediated memory in our older subjects. If actually the most frequently encountesed value (mode) of magnitudes characterising the memory of rtudent subjects in the third series fell to a maximum of 15 does that not mean that the convergence of indices we noted above only depends on this insufficiency in the number of words of the series, i.e. on the fact that in the given conditions the task is not difficult enough for the psychological capacities of the subjects? Although this argument contains the quite correct statement that, with an increase in the number of words to be memorised, we can also expect a rise in the indices, it is still refuted, as regards its main idea, by a whole series of arguments.

First of all, it is quite obvious that the necessary limit on the number of words in a series is naturally no more 'artificial' than any limitation of a specific problem. The sense of our statement is just that, when material of a

certain degree of difficulty is being memorised, the introduction of an aid affects the efficiency of memorising in a quite different way in the subjects of different age groups. On the other hand, the number of words we took for a series was not fortuitous and, as will be seen from the frequency distribution curves, is roughly the number that probably actually corresponds to the mode, at least in subjects of older school age, irrespective of whether the curve is continued a little toward higher figures. Finally (and this is most important), when a series (the fourth series) is made more complicated, which is undoubtedly equivalent to prolonging it, we still observe a reduction in the coefficients of relative increase. Despite the fact that the mode did not, in any case, coincide with the maximum possible value in the fourth series, the pattern we have noted held completely, as before, and we could therefore meet this possible objection simply by transferring our analysis from the third series to the fourth, although (we repeat) there was no need to do so, because even a shift of the mode to the last value in the series would not change anything as regards the essence of our statement.

Ignoring the findings of the first series with meaningless syllables for the time being, and summarising only the data of our investigation of the development of memorising of the meaningful words presented, we come to the following conclusion stemming from analysis of the appropriate indices.

At the earliest stages of development of memory (children of early preschool age), the introduction of the second series of symbol-stimuli into the experiment, which could, by becoming part of the memorising operation as 'memory aids', have converted it into an indirect, significative one, did not in fact increase its efficiency; the operation remained direct and natural. At the next level of development of memory (younger schoolchildren), characterised by a preliminary, extremely vigorous rise in the indices of externally mediated memory, the introduction of the second series of stimulus-aids was a decisive circumstance, on the contrary, as regards efficiency of the operation; this was the moment of maximum divergence of the indices. At the same time, it was from then on that their rate of increase in both the main series changed markedly: the increase in the indices of externally mediated memory was slower and con-

tinued the rate of development of memory without the aid of external symbol devices, as it were, while the development of memory based on external, auxiliary stimuli, which had been more rapid prior to this, changed over to externally mediated remembering, which at the next, highest level of development again led to convergence of the coefficients. The general dynamics of these two lines of development can be expressed most simply in the graphic form of a parallelogram, one pair of whose opposite angles is formed by the convergence of the indices at their upper and lower limits, while the other two angles, connected by the shorter diagonal, correspond to the moment of greatest divergence. Later, from now on, we shall designate this pattern of the development of memory briefly by the arbitrary term 'parallelogram of development'.

The hypothesis that, from our viewpoint, provides the only explanation for the dynamics of memory indices noted has been expressed in very general terms above. The facts underlying it—on the one hand, a predominant development of the capacity to memorise meaningful material and, on the other hand, the tremendous difference in the results of 'mechanical' and 'logical' memory, which, according to the findings of workers who investigated this problem, is expressed by a ratio of 1:25 or 1:22—are sufficient evidence that modern man's memory is not at all an expression of an elementary, purely biological property but is an extremely complex product of a long process of cultural and historical development. This development, of which we have spoken above and to which we shall return again and again in the future, takes the line of mastery of the acts of one's own behaviour, which is transformed from natural behaviour into complex, significative behaviour, i. e. into behaviour based on a system of arbitrary symbol-stimuli. Before these symbol-stimuli become *internal* they appear in the form of stimuli acting from outside. Only through a kind of process of 'ingrowth' are they converted into internal symbols and, in that way, into higher, 'logical' memory developing from the original, unmediated, direct memory. In the conditions of our experiment, preschool children's memory process remained natural and unmediated; they were unable to make adequate use of the external series of stimuli we gave them in the form of our picture cards; nevertheless, they could, naturally, involve internal elements of their

experience as memory aids. Only older subjects gradually mastered the appropriate method of behaviour, and their remembering by means of external symbols, as we saw, largely increased in effectiveness. At the same time there was a certain increase in the efficiency of their remembering without external support, which could also be converted to some extent into mediated memory. It developed particularly actively, however, after a child had fully mastered memorising by means of external symbols; in order to become internal, a symbol must first of all be external.

While preschool children's memorising remained equally direct in both basic series of our experiments, at the opposite pole, among our student subjects, it was also equal, but equally indirect, with the difference only that they retained one of the series through external symbols and the other by means of inner ones. By tracing the transition between these two extremes in the experiments, we divided the process up, as it were, by our method and were able to reveal the mechanism of the transition.

The principle of the parallelogram of development is nothing other than an expression of the general law that *the development of higher human forms of memory passes through a development of memorising by means of external symbol-stimuli.* This transformation of external symbols into internal symbols or, as we put it, their 'ingrowth' is so far only a hypothesis.

Man's psychological development evolves, as we have seen, under the influence of an environment unknown to the animal kingdom, namely the social environment. That is why it consists not only in a development of ready-made, biologically inherited ways of behaviour but is also a process of acquiring behaviour of new, higher forms, forms specifically human. These higher forms arise because the social environment, while emerging as an object of adaptation, at the same time itself creates the conditions and means for that adaptation. That, too, is its profoundly original nature. Under its influence previously biological development is transformed into mainly historical, cultural development; the pattern established by our research is thus one of historical rather than biological development.

Man, by interacting with his social environment, reconstructs his behaviour; assimilating the behaviour of other people by means of special stimuli, he acquires the capacity to

master his own behaviour as well; previously interpsychological processes, for instance, are converted into intrapsychological ones. This relation, which emerges with special force in the development of speech, holds equally for other psychological functions as well. It is also what constitutes the path of development of the higher forms of memory; modern man's memory, as we have seen, is not an elementary, purely biological property, but is the extremely complicated product of long historical development. This development, following the line of mastering the acts of his own memory from outside, is conditioned above all by the possibility of individual psychological operations acquiring the structure of interpsychological operations. At the same time the external form of intermediate stimulus-devices, which constitutes a necessary condition of their involvement in these interpsychological operations, already loses its significance in intrapsychological operations. Through a kind of 'ingrowing' process, previously external stimulus-devices thus prove capable of being transformed into internal means whose existence also constitutes a specific feature of 'logical' memory.

The principle of the 'parallelogram' of the development of memory proposed by us is nothing else than an expression of the general law that the development of higher, significative forms of memory follows a line of transforming externally mediated remembering into internally mediated remembering. This process of 'ingrowing' that we have traced experimentally cannot be understood in any way as simple replacement of the external stimulation by its engram and is associated with deep-seated alterations in the whole system of man's higher behaviour. In brief, we might describe it as a process of the socialisation of man's behaviour, because the role of the social medium is not limited here simply to its emerging as a central factor of development; man's memory, like his higher behaviour, remains associated with it as well in its very functioning.

If we trace the genetic succession of the psychological processes and operations by which man realises the business of remembering, and which is the real content of the historical development of memory, then, instead of the old idea of the existence of two different memories alongside one another, there opens out before us a single process of the development of a single function.

The essence of this process is that, instead of memory as a special biological property, a complex functional system of psychological processes grows up at the highest stages of behaviour that performs the same function as memory in the conditions of man's social existence, i. e. realises remembering. This system not only extends the possibilities of memory infinitely and transforms animal memory into human memory, but it is differently structured and functions by its own peculiar laws. The genesis of just such a system in place of an ordinary, simple function is most essential to this process of development. That does not, moreover, at all constitute the privileges of memory alone but is a much more general law governing the development of all psychological functions. This higher memory, subordinated to the power of man himself, i. e. to his thought and will, not only differs from primary, biological memory in its structure and in mode of activity but also in its relation to personality as a whole, which means that together with the cultural transformation of memory the utilisation itself of past experience (whose retention we owe precisely to memory) also acquires new, higher forms: by getting control over our memory we free our whole behaviour from the blind power of the automatic, spontaneous effect of the past.

In tracing the historical development of the theory of memory, we have seen that the reverse side of the problem of memory's evolution is constantly another problem, that of the trainability of memory. To appraise the significance of the historical point of view for solving this problem in the theory of memory, and in particular the significance of the data obtained in our research, it is enough to recall that a consistent view of memory as a biological function has led even the most progressive psychologists to a kind of pedagogic fatalism in opinions on the possibility of perfecting memory. Memory used to be considered a blind, inert natural force that could not be altered by any training efforts, could not be perfected or raised to a higher degree. At best only a problematic possibility of increasing the effectiveness of its operation was admitted, by choosing the most economical modes of remembering corresponding to the natural character of memory. The variability, and educability of this function are only revealed together with a radical change in the view of memory and disclosure of its historical development. With recognition of the variability

of its forms and modes of functioning, the pedagogics of memory gets real psychological substantiation for the first time, and the affecting of memory is advanced as a scientifically grounded task, fully realisable in practice, which, with other similar tasks, will enable education to penetrate really deeply into the child's development and so subordinate the forming of the whole higher stratum of the individual's psychological functions to its objectives.

THE PSYCHOLOGICAL PRINCIPLES OF PRESCHOOL PLAY

1

At the beginning of the preschool period of a child's development a discrepancy of sorts comes out very distinctly between its activity on the one hand, which is already quite complex at this stage of development, and the process of satisfying its basic vital requirements, on the other. Satisfaction of its vital needs is actually still distinct from the results of its activity: a child's activity does not determine and, essentially, cannot determine satisfaction of its needs for food, warmth, etc. Characteristic of it, therefore, is a wide range of activity that satisfies needs which are unrelated to its objective result. In other words, many types of child's activity at this period of development have their motives (that which stimulates activity) within themselves, so to speak. When, for example, a child taps with a stick or builds blocks, it does so not, of course, because this kind of activity leads to a certain result that meets some one of its needs; what motivates it to act in this case lies apparently in the content of the actual process of the given activity.

What type of activity is characterised by a structure such that the motive lies within the process itself? It is nothing else than the activity that is usually called 'play'.

We encounter play activity already in certain higher animals, but the play of children, even at an early age, is not at all like that of animals. Where does the specific difference between animals' play activity and play, the rudimentary forms of which we first observe in preschool children, consist in? It lies in the fact that it is not instinctive activity but is precisely human, object activity, which, by constituting the basis of the child's awareness of the world of human objects, determines the content of its play. That, too, primarily distinguishes a child's play from that of animals.

In the pre-preschool period of a child's life, the development of play is a secondary, reflected, and dependent proc-

ess, while, on the contrary, the moulding of object activity of a non-play type constitutes the main line of development. During subsequent development, however, and precisely in the transition to the stage that is connected with the pre-school period of childhood, the relation between play and the activities that satisfy non-play motives becomes different—they change places, so to speak. Now play becomes the leading type of activity.

What is the reason for this change, as a result of which play is converted from a subordinate, secondary process into a leading one? It consists in the fact that the object world of which the child is aware is progressively expanding for it. This world includes not only the objects that constitute the child's immediate environment, objects with which it can act and does act itself, but also objects with which adults act, with which the child is not yet able actually to operate, which are still beyond its physical capacity.

Underlying the transformation of play during the transition from the pre-preschool period to preschool childhood there is thus an expansion of the range of human objects whose mastery confronts a child as a problem and the world of which it becomes aware of in the course of its subsequent psychic development.

How does a child become aware of this larger world of human objects? How generally does awareness of the object world occur at the initial levels of its mental development? It is the path of becoming aware of the human attitude to objects, i. e. of human *actions* with them.

For the child at this level of psychic development there is still no abstract theoretical activity, no abstract contemplative cognition, and awareness therefore emerges in him primarily in the form of action. A child mastering the world around him is a child striving to act in this world.

During its development of awareness of the object world a child therefore tries to enter into an active relationship not only with the things directly accessible to it but also with the broader world, i. e. strives to act like an adult.

The world of human objects is still disclosed to a child in an extremely naive form. The human aspect of things still appears to it directly in the form of human action with these things, and man himself appears to it the ruler of things who acts in this object world.

A really notable aspect of this is that in the initial

stages of development of its conscious mind a child does not make a fetish of things and does not contrast two worlds: that of the abstract, physical properties of objects and that of human relations to them.

It is during this period of a child's development that the classical formula 'Myself' is created; 'Myself!' it says and converts the adult's mode of action into the content of its own action; acting like a person with respect to the object, he becomes aware of it as a human object. 'Let me' is the formula that expresses the real essence of the psychological situation in which a child finds itself on the borderline of this new stage in its development—on the borderline of preschool childhood.

This situation is also the source of the rise of a new, very unique contradiction. Let us analyse this contradiction first in its external expression. The external form of expression of this new contradiction arising at the upper limit of pre-preschool age, consists in a conflict between the child's classical 'Let me' and the adult's no less classical 'Don't'. It is not enough for a child to contemplate a moving car or even to sit in it; it must *act*, must drive it, must rule it.

In a child's activity, i. e. in its real internal form, this contradiction comes out as one between rapid development of its need to act with objects on the one hand, and the development of operations performing these actions (i. e. modes of action), on the other. The child wants to drive the car himself, it wants to row the boat himself but cannot do so and cannot primarily because it has not mastered and cannot master the operations required by the real object conditions of the given action.

How is this contradiction resolved, this discrepancy between its need to act, on the one hand, and the impossibility of performing the operations required by the actions, on the other? Is it resolvable at all? It can be resolved, but for the child only in a single type of activity, namely in play activity, in a game. This is due to the fact that a game is not productive activity; its motive does not lie in its result but in the content of the action itself. Play is therefore free of the obligatory aspect of the given action, which is determined by its actual conditions, i. e. is free of obligatory modes of acting or operations.

Only in play can the required operations be replaced by others and can the object conditions be replaced by other

object conditions, the content of the action itself being preserved. A child's mastery of a broader area of reality not directly accessible to it can therefore only be accomplished in a game. Because of that, the game acquires a very unique form, qualitatively different from the form of play we observe in pre-preschool age, and at this higher stage of the child's mental development now truly becomes the leading activity.

The leading role of play at the preschool age is recognised by practically everyone, but in order to master the process of the child's psychic development at this stage when play had the leading role, it is certainly insufficient just to recognise this role of play. It is necessary to understand clearly in just what the leading role of play consists; the laws of play and of its development have to be brought out. A child's mental development is consciously controlled mainly by controlling its main, leading relation to reality, by controlling its leading activity. In this case play is the leading activity; it is consequently essential to know how to control a child's play, and to do that it is necessary to know how to submit to the laws of development of play itself, otherwise there will be a breakdown of play instead of control of it.

What, in general, is *leading activity*? We mean by it not simply the activity that is most often encountered at a given level of a child's development. Play, for example, by no means occupies most of a child's time. The preschool child does not play more than three or four hours a day. Hence, the point is not the quantitative place that the process occupies. We call leading activity that in connection with whose development the most important changes take place in the child's psyche and within which psychic processes develop that pave the way for the child's transition to a new, higher level of development.

Hence, with respect to play, as to any leading activity in general, our task is not only to explain this activity from the child's mental aptitudes already formed but also to understand, from the origin and development of play itself, the psychic connections that appear and are formed in the child during the period when this is the leading activity.

What is the play of the preschool child, play in its most striking, distinctive expression, play in the 'classical' pe-

riod, so to speak, of its development? We have already seen what the need for the rise of preschool play consists in. Now we must go into the laws of this activity and its development.

There are a host of views about play in psychology, and a host of theories about it. It is sufficient to list only the best known ones to realise how many persons have concerned themselves with children's play: there are the theories of Schiller and Spencer, the well-known theories of Groos, Hall, Bühler, Stern, Dewey, and Koffka; original views on play are being developed by Piaget and Janet; the theory of the physiologist and psychologist Buytendijk is well known; in the Soviet Union a theory of play has been developed by Vygotsky, and recently Rubinstein has made an analysis of play activity.[1] We do not have the space here to survey and analyse all these theories. We shall therefore limit ourselves to trying to give a positive answer to the problem of play, drawing on the work of Elkonin and Fradkina, and of Lukov, who has made an experimental study of the play of children of pre-preschool and preschool age, based on a hypothesis suggested by Vygotsky.

2

As we have already said, play is characterised by its motive's lying in the process itself rather than in the result of the action. For a child playing with wooden bricks, for example, the motive for the play does not lie in building a structure, but in the *doing*, i. e. in the content of the action itself. That is true not only of the preschool child's play but also of any real game in general. 'Not to win but to play' is the general formula of the motivation of play. In adults' games, therefore, in which winning rather than playing becomes the inner motive, the game as such ceased to be play.

That, however, is too general a characterisation of play, for play develops, and the way a preschool child plays is something quite different to the way a schoolchild or an adult plays. So it must be approached very concretely, without restricting oneself to general statements (which,

[1] See: S. L. Rubinstein. *Osnovy psikhologii* (Principles of Psychology), Uchpedgiz, Moscow, 1935.

incidentally, is one of the main drawbacks of most theories of play), but bringing out what is specific to it for each stage of its development. First of all we must seek out the specific features of preschool play.

There are forms of play that differ in their content and origin. There are games, for example, that are played only in a certain situation, and that disappear with the situation; they are individual and unrepeatable. Such a game begins suddenly, is played, and disappears forever; it is the child of chance conditions and has no traditions. There are also traditional games, like hopscotch. The rules may vary, and the way of marking out the squares may vary, but the principle of the game remains unchanged.

It is an interesting point that the history of play indicates that such games have sometimes existed for a hundred, even a thousand, years.

There are also games with a shorter tradition—they arise for the first time in a certain group of children, and are then converted into a traditional game for that group only.

Play is thus unusually varied not only in its content but also in its forms and sources. To try and bring out its psychological essence, however, we must begin by analysing a very simple example, a child's simplest play activity.

Recall such a simple game as riding a hobby-horse. It is also play and, moreover, very typical play. Compared with other games it is very simple. Let us try and analyse it.

It is said that play is the result of a certain excess of energy in a child, which is expended in the course of playing. Some excess of energy is obviously needed, of course, for a child to be able to gallop around a room on a hobby-horse, but that is still far from an explanation, because the whole problem is why does it expend its energy precisely in that way and not in some other way, i. e. why precisely does it gallop and why precisely on a hobby-horse? That is often answered as follows: a child gallops on a hobby-horse because its fantasy has been stimulated; it imagines the stick to be a horse and correspondingly acts as if it were a horse, i. e. it straddles it and rides. That explanation is not only actually false, but is unsound in principle. That is just the kind of explanation, the kind of approach to a child's activity, that deduces it from the changes already existing in its consciousness and formed somewhere, while the

main line of psychological analysis should always take the opposite direction, namely, should begin by examining the child's real activity so as, from that, to understand the corresponding changes in its consciousness, and only then to discover the reverse effect of this now changed consciousness on the further development of activity.

We already know how play arises in the preschool child. It arises from its need to act in relation not only to the object world directly accessible to itself but also to the wider world of adults. A need to act like an adult arises in a child, i. e. to act in the way it sees others act, in a way it has been told about, and so on. It aspires to ride a horse, but does not know how to, and is still unable to learn to do so; it is beyond its powers. A kind of substitution therefore occurs; an object belonging to the world of objects directly accessible to it takes the horse's place in play.

Assuming that our supposition is correct (below we shall test its correctness experimentally), let us see what we find in this play process, in this activity of the child. First of all, we find a certain action in it, namely riding a horse. Let us now try and analyse that. Any action has a conscious aim, to which it is directed. The aim of this play action is not to ride somewhere, but to *ride* a horse.

Another thing that characterises any action is the operation, the means, by which it is realised, i. e. that in it which is governed by the real, object conditions and not simply by the aim as such. In play action we also find an operation, of course, i. e. the means by which it is realised, but we also find a special kind of relation between this operation and the action. The operation here does not always correspond to the action; the operation corresponds to a stick and the action to a horse.

We must dwell on that paradoxical relation in more detail. At first glance it may seem that the action itself here also does not correspond to the aim but to the play object, the stick, and that it consequently has nothing in common with the real action. But that is not so. In play the action always corresponds, albeit in a unique way, with the action of people in relation to the purpose.

Here is an example from Fradkina's work. Under the impression of vaccination, children play at inoculation against smallpox, and in doing so act in the same way as adults, that is to say, they really wipe the skin of the arm 'with

spirit', and then make a 'scratch', and then rub in 'vaccine'. The experimenter intervenes in the game and asks: 'Would you like me to give you real surgical spirit?' The proposal is greeted, of course, with enthusiasm, for it is much more interesting to use real spirit than imaginary alcohol. 'You go on vaccinating while I go for the spirit', the experimenter says, 'vaccinate first, and later you can rub with real spirit.' That suggestion, however, runs counter to the laws of play and is categorically rejected by the children. It is much more attractive to use real spirit, of course, but it cannot be rubbed on after the vaccination. That alters the action, and is a departure from the real action, which consists in wiping the skin with spirit first and then making the scratch. The opposite is never done; therefore it is better to let the spirit be imaginary; then the action itself will be completely in accord with the real thing.

In a game the conditions of the action can be changed: paper can be used instead of cotton wool, a sliver of wood from building material, or simply a stick, instead of a needle, imaginary liquid instead of surgical spirit, but the content and the sequence of the action must obligatorily correspond to the real thing.

The content of the play process brought out by a psychological analysis, what we call the action, is thus the *real* action for a child. The child takes it from real life. It is never, therefore, made up arbitrarily; it is not fantastic. What distinguishes it from non-play action is solely its motivation, i.e. that it is psychologically independent of its objective result, because its motive does not lie in that.

Let us now pass to an examination of play operations. Is it the operation, perhaps, i.e. the mode of the action itself, that does not correspond to reality and that therefore gives play its intrinsic fantastic character? It proves, however, that the play operation, too, is a quite real one and cannot be otherwise, because the play objects themselves are real. A child cannot act 'unreally' with a stick.

I would make an observation here that clearly indicates how real is the reality of a playing child's operations. When its parents are not there it may use a breakable porcelain ornament for its game. Consider the child's movements. Does it take this object's fragility into account? Of course it does, and even with a certain exaggeration. It may still happen, it is true, that the child will, for all

that, break the ornament, but that does not, of course, characterise how far the mode of its action has been adapted to the real object. As a rule the mode of action, i.e. the operation, always corresponds exactly to the object with which the child is playing. If a chair is fulfilling the function of a motorcycle in a game, the child's movements correspond strictly to the properties precisely of the chair and not at all to those of a motorcycle. The play operation, like the action, is thus also strictly real, because the objects to which it corresponds are themselves real. Many games therefore require a certain skill and dexterity of action, of motor knack.

These separate realistic elements of play, it is true, are related to each other in a very unique way. The operations are at variance, so to speak, with the action. No wonder the old saw says you'll never ride far on a stick. Play operations are inadequate to action oriented on a certain result. You can't ride far, it is true, but in play the action, however, does not pursue that aim, for its motive lies in the action itself and not in its result.

So we again reach a rather paradoxical result: we do not find any fantastic improbable elements in the structure of play in which there is so much fantasy. What does the consciousness of the playing child really reflect? First of all, the image of a real stick calling for real operations with it. Then the content of whatever action the child is repr ducing in play, and reproducing with great pedantry, is reflected in its consciousness. Finally, there is the image of the object of the action, but there is nothing fantastic in it; the child imagines the horse, of course, quite adequately. So, in the psychological *premises* of the game *there are no fantastic elements.* There are a real action, a real operation, and real images of real objects, but the child, all the same, acts with the stick as with a horse, and this indicates that there is something imaginary in the game as a whole, which is the *imaginary situation.* In other words, the structure of play activity is such that an imaginary play situation arises.

The play action, it must be stressed, does not come from the imaginary situation, but the latter, on the contrary, is born from the discrepancy between the operation and the action; thus it is not imagination that determines the play action but the conditions of the play action that make imagination necessary and give rise to it.

How then does an imaginary play situation arise? How does a stick become converted into a horse for the playing child? Above we distinguished two aspects of activity.

(1) There is action as a process directed to a goal recognised in connection with a definite motive; this is the aspect of activity inwardly associated with the 'unit' of consciousness that we designate by the term 'personality sense'.

(2) We distinguished the content or aspect of the action that corresponds to its conditions; this is the operation. A singular 'unit' of consciousness, namely, *meaning*, is also associated with this content of the activity.

In a normal productive action meaning and sense are always linked together in a certain, albeit different, way. That is not so in play action.

An imaginary play situation arises as a result of the objects, and that means the operations with these objects, being part of actions that are normally performed in different object conditions and in relation to other objects. The play object retains its meaning, i.e. the stick remains a stick for the child, its properties are known to the child, the mode of possible use and of potential action with it is known. That is what forms the meaning of the stick. It turns out, however, that meaning is not simply concretised in the play process. In play the operations with the stick form part of a quite different action than the one to which they are adequate. The stick, correspondingly, while retaining its meaning for the child, at the same time acquires a quite special sense for it in this action, a sense that is just as foreign to its meaning as the child's play action is to the object conditions in which it takes place; the stick acquires the sense of a horse for the child. This is a *play sense*. This split between the sense and meaning of an object in play is not given in advance, as a prerequisite of play, but really arises in the process of play itself. That is demonstrated by the undoubted, experimentally established fact that a child does not imagine a play situation when it is not playing.

Let us take an example from Lukov's research.[2] Children are playing 'kindergarten' in a room. Two are playing while a third has not yet been drawn into the game but is sitting and watching the players. During the game they

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[2] See: G. D. Lukov. *Art. cit.*, p 15.

decide to move the furnishings of the 'kindergarten' on a toy cart, but there is no suitable 'horse' for the purpose. One of the players suggests using a block as the horse. The child watching the game cannot refrain from commenting, of course, and its remarks are full of the greatest scepticism. 'How can that be a horse?' Like any child, he remains a realist. But now he becomes tired of watching and joins the game; when we listen now to his own play suggestions, it turns out that in his opinion now the block can not only be a horse, but even a team of horses.

The particular relation between the sense and meaning of play is thus not given in advance in the game's conditions but arises in the course of it. And, we must add, the relation of the play sense and the real meanings of the game's object conditions does not remain immutable during the movement of the play process but is dynamic and mobile. That is indicated, above all, by the facts relating to the phenomenon sometimes observed of children's 'being carried away in a game'. The phenomenon expresses itself as follows. At the beginning of a game you can cut a child's play activity short and it will easily come out of the play situation, crossing the forbidden line, for example, that designates the 'captivity' into which it has fallen, but when the game has gone on for quite a long time, and the action in connection with the play object conditions has been repeated many times, a peculiar phenomenon can be observed. The game is broken off, but the child is still in the grip of the play sense; the sense that arose in the game has overshadowed the real meaning of the line, as it were, and for a moment the child acts (but only for a moment) as if it had lost the real, actual meaning of the line, as if this were not a simple line before it but a real obstacle. In that case we say that the child 'has been carried away', that it has got so involved in the game that it has begun to lose its sense of reality. But that is not true. A child is never like a person in the grip of hallucinations For it the line is never transformed into the *image* of a barrier. The phenomenon described depends on the relation between the play sense and the meaning of the real object conditions having become altered a little during a long game; the play sense has overshadowed the real meaning, as it were (but not the image!).

A second phenomenon characteristic of the dynamics

of the relation of sense and meaning in play is that of using an object to the best effect, for example a doll, part of the garden, etc. As we well know, a child prefers to play with an old doll, which it perceives in a more intimate, closer way than a new one. It has invested the object with its play attitude to it, as it were. This attitude is not simply crystallised in the child's consciousness itself, but is projected by it so to speak and attached by association to the play objects, the toys. This is also the process of 'making the most' of them or 'exploiting' them. A doll, a corner of the garden that is now filled with mysterious, tempting dangers that arouse a whole range of feelings, are thus 'exploited', a discarded carriage, converted in play into the heroic image of a fighting, machine-gun-carrying *tachanka*, is 'exploited', and so on.

3

In preschool play a child's operations and actions are thus always real and social, and in them it assimilates human reality. Play (as Gorky said) really is 'children's path to understanding the world in which they live and which they are called on to change'. Play therefore does not at all arise from autistic fantasy, arbitrarily building the child's imaginary play world; the child's fantasy itself is necessarily engendered by the game, arising precisely on this path of the child's penetration of reality. We have to stress this specially because, although play and fantasy are normally associated, they are associated by reciprocal relations. The characteristic features of a child's play activity arise from its fantasy as from a capacity or function 'inherent' in it and are derived from it, i.e. they delineate a path opposite to real development.

The cognitive significance of play is clarified and emphasised in connection with another remarkable feature of children's play activity, namely that this activity is always generalised, i.e. is always *generalised activity.*

A child imagining itself in play to be a chauffeur, perhaps reproduces how the only chauffeur it has ever seen, acted, but its action itself is a representation not of a given concrete chauffeur but of a chauffeur in general, not his concrete actions as observed by the child, but the actions

of driving a car in general, within the limits, of course, of the comprehension and generalisation of them accessible to the child. That is because the motive for the child is not to depict a concrete person but to perform the action itself as a relation to the object, i.e. precisely a generalised action.

This feature of play activity emerges with special clarity when some action that a child has already fully mastered is included in its play activity. Let us examine, for example, first how a child drinks tea in ordinary circumstances, and then trace how it does so when it is playing 'drinking tea'. It stirs its 'tea' with a spoon, and raises the cup to its mouth, but all these movements are only a generalised image of the corresponding real action. When the child is playing it does not imitate even its own concrete action; it does not dramatise, and does not transmit anything specially characteristic of a given character; in both its play actions and its separate play operations it reproduces the typical, the general. That, incidentally, is the qualitative difference between reproduction in play and real dramatisation.

It is the generalisation of play actions that enables a game to be played in inadequate object conditions.

Because play action has a generalised character, the modes of action themselves, and consequently the object conditions of the game, can be altered within very broad limits. These limits are far from infinite, of course, because the play operation, while determined by the existing object conditions, is at the same time always subordinated to the action. Therefore, not everything in a game can by any means be everything. That has been convincingly demonstrated by the special research carried out by Morozova; we also find it confirmed in Lukov's work cited above.

When a child seated at a table creates a play situation in which a walking person figures (for example, a doctor hurrying to a patient or to a chemist's shop), a pencil, a stick, or a match can equally serve as the person. With these objects the child can successfully perform the operation of changing position, i.e. the generalised movement demanded by the play action. It is another matter if the child has a soft ball in its hand. The required action is impossible with it; the movement lacks the characteris-

tic configuration of 'walking', and a moment occurs at which the play action is no longer possible.

So, not every object can be everything in play. Different play objects, or toys, moreover, may fulfil different functions, depending on their character, and participate differently in the structure of the game. To avoid returning specially to this point, let us note in passing the main differences that distinguish various play objects in this regard.

First of all, there are toys of broad scope, so to speak (sticks, blocks, etc., whose place in play we have already described); they can take part in diverse actions. In contrast to them we can differentiate specialised play objects, specialised toys; among them we must distinguish toys without fixed functions and ones with such, for example, a toy representing an acrobat swinging on a horizontal bar. That is a pseudo-toy. A child watches it with delight for a time, then discards it. In another, happier case, the child thinks out how to separate the acrobat from the bar, and begins to act with it as with a real toy. But there are also specialised toys of another type, for example clockwork motor cars, mechanical railways, etc. These are real toys but they are involvable only at a certain level of development of play. Whether a child needs a mechanical toy or not, therefore, whether it will act with it utilising its specific properties, or will play with it without involving those properties, will depend at what stage of development of play it is.

How then does play develop? Our job is not to give a simple description of the development of play, which we can get from the prolific literature. Our task is to try and analyse the process of development itself of preschool play and discover the reasons for its changes and its decay, and finally its links with the preschool child's other forms of activity. For this we shall rely once more on Elkonin's work.

4

The initial form of play in preschool childhood is expressed in the games that we have already considered, for example the play of a child riding a hobby-horse. The characteristic, basic thing that strikes the eye in these games is the

existence of an imaginary situation. What is this imaginary situation?

This situation, as we have already seen, is not an initial constituent factor of play but, on the contrary, a resultant moment. The constituent factor is the reproduction of action or, as it is sometimes expressed, the *play role*. The play role is the action being reproduced by the child. It plays the part of a horseman, for example. These games are even called 'role games' (or plot games), in which the role the child gives itself takes first place. In the play role here the child takes on a certain, generalised, social function of an adult, most often an occupational function: the caretaker—a man with a broom, a doctor—who ausculates, or vaccinates; an officer—one who gives orders in war, and so on.

An apparent exception to this is animal games in which storybook personages appear. Children say, for example: 'you be a sheep, you be a fox', and so on, and a Noah's Ark kind of situation is pretended. In fact, however, 'playing animals' is not an exception. The point is that both in fairy-tales and in play the animals figure as bearers of generalised human properties and functions; in these fairy-tales and animal games only the concrete subject of the action is altered, the action itself, and the relations themselves into which it enters while the surrounding world remains human and profoundly realistic.

In subject or 'plot' games, the playing child thus gives itself some human, social function or another, which it performs in its actions.

A child plays being a chauffeur, or a nursery-school teacher, etc. constructing an appropriate situation and plot of the game. This is the overt object content of the game that directly strikes the eye, but in a subject game there is necessarily also another constituent element. This is the rule of the action latent in any play role. When a child takes on the role in play, for example, of a nursery-school teacher, it conducts itself in accordance with rules of action that are latent in that social function; it organises the behaviour of the children at table, sends them for their nap, and so on.

The unity of the play role and the play rule expresses the unity of the physical and social content of preschool play about which I have already spoken and which is preserved throughout this stage.

This unity, however, does not remain the same, but changes during the development of the child's play activity. The classic games with which the preschool child's play begins are plot games with an overt play role, an overt imaginary situation, and a latent rule. The law of the development of play, as Elkonin's experimental findings indicate, is also that play evolves from a previously overt play role, imaginary situation, and latent rule to an overt rule and, on the contrary, to latent imaginary situation and role. In other words, the main change in play that occurs during its development, is that role games with an imaginary situation are transformed into games with rules in which the imaginary situation and play role are contained in latent form.

Games 'with rules', i.e. like hide-and-seek, table games, etc. differ sharply from such 'role' games as playing doctor, polar explorer, etc. They do not seem to be related to one another by any genetic succession and seem to constitute different lines in the development of children's play, but in fact the one form develops from other by virtue of a need inherent in the child's play activity itself, whereby games 'with rules' arise at a later stage.

Let us take a short description of an experiment made by Elkonin.

The experimenter is playing hide-and-seek with a three-year-old child. When the child has hidden the experimenter does not 'find' it immediately but deliberately waits near the child for a minute or two pretending not to be able to find it. Then the tot cannot restrain itself from breaking the rule, and almost immediately begins to shout: 'Uncle, here I am!' A six-year-old child plays hide-and-seek quite differently. For it the main thing is to stick to the rule. The experimenter conceived the idea of telling both children (the three-year-old and the six-year-old) to hide together. He again pretended that he could not find them. Soon the children's excited voices were heard, and then a muffled noise. The little one was trying to give itself up while the six-year-old was preventing it from doing so. Exclamations were heard: 'Quiet, keep still!' Finally the older child tried to stop the little one's mouth—matters came to very vigorous measures to make the younger child observe the rule. The difference in the behaviour of the two children in this experiment was revealed in remarkably obvious, clear form.

How do games with rules arise? They grow out of 'role' games with an imaginary situation: 'cats and mice', 'wolves and sheep'—from the very names of these games it is obvious that they come from games with roles.

The fact that games with rules come into being from 'role' games with an imaginary situation is fully confirmed by the findings of special observations and research. It is indicated, finally, by an experiment in practical training of an ability to obey the rule in junior preschool children that was specially made to check this proposition.

It is very difficult for a small child of three or four, as we have already said, to force itself to keep to the rules of a game; games with rules are therefore later ones. On the assumption that the rules grow from the role by which they are justified, ordinary games 'with rules' were altered so that the rule in them was based on the role and the imaginary play situation. In order to make 'cats and mice' easier for the child, the players were given special 'attributes' that made some 'cats' and others 'mice'. These attributes do not, of course, have to be masks of the appropriate animals; any detail that can serve as a sign of them will do: a tail tied-on, a paper hat with ears, and so on. The child enters the game through the attribute, and in the role it naturally sticks to the rules of the game.

In this way, interestingly, it was possible to shift the possibility of games with rules to a much earlier stage of development.

In the transition from games with an overt role, an overt imaginary situation, and a latent rule to ones with a latent imaginary situation, a latent role, but an overt rule, the general law of the development of the forms of preschool play is expressed. In order to get to the *cause* of its development we have to consider the change in the *content* of the child's play activity itself and disclose the dynamics of its motivation.

Why do games with rules only arise at a certain stage of development, and not simultaneously with the genesis of the first role games? It depends on the difference in their motivation. Initially the first play actions arise on the basis of the child's growing need to master the world of human objects. The motive contained in this action itself is fixed in a thing, directly in its object content. The action here is the path for the child that leads it first of all

to the discovery of objective reality; the human still emerges for the child in its objectified form. The role of the horseman, the play action of riding, is playing at horses; the action with a block of wood that the child 'drives' from one chair to another, is playing cars.

But during the development of these games the human relation included in their object content itself comes out ever more clearly in them. The tram driver not only 'acts with a tram' but is obliged at the same time to enter into certain relations with other people—with the conductor, the passengers, and so on. Therefore, at relatively early stages of the development of play activity, a child finds *not only man's relation to it* in the object, *but also people's relations with one another*. Group games become possible not only 'alongside one another' but also 'together'. Social relations already come out in these games in overt form—in the form of the players' relations with one another. At the same time the play 'role' is also altered. Its content now determines not only the child's actions in regard to the object but also its actions in regard to the other players in the game. The latter also become content of the play activity, for which its motive is fixed. Games are distinguished in which actions in regard to other people become the main thing.

Let us take an example of such play among junior preschool children (from Fradkina's research).

The experimenter suggested that Galya be the nursery-school teacher, and that she herself and Galochka be children. Galya said, smiling: 'Yes, I'll be F.S. (as the nursery-school teacher was called), and you will be Galya, alright?' Without waiting for a reply Galya begins giving instructions: 'Sit down at the table. No, first wash your hands over there,' and points to the wall. Galochka goes over to the wall, followed by the experimenter. Galochka makes motions as though washing. Galya continues: 'Sit down at the table; here's a roll and a cup I've already got ready. Now I'll pour the tea.' She picks up dry leaves from around the flower pots and puts two or three into three heaps. Galochka and the experimenter sit down at the table, Galya looks at them seriously and then says: 'Galya, sit still. Don't chatter at table.' She sets out another pair of leaves. Vilya comes up, also sits down at the table, and begins to eat. Galya: 'Now you can go and have a nap.' Galocka:

'First rinse my mouth.' She goes to the wall and makes the motions of rinsing her mouth. Galya points to some chairs: 'Sleep there'. Galochka, Vilya, and the experimenter sit down. Galya: 'Close your eyes. Put your hands under your head.' Vilya fidgets. Galya: 'Vilya, lie still. Don't toss about!' Vilya quietens down.

Galya: 'You've had your nap now. Get up and get dressed.' Vilya, Galochka, and after them the experimenter, pretend to put on their shoes and button up their overalls. They sit down at the table. Galya: 'Drink your tea.' She sets a wooden cylinder from a set of building blocks in front of each of them and begins to pour from another. 'That's tea,' she explains. She goes off and brings back several semi-spherical blocks and hands them round, saying: 'Buns. There's one for everyone.' She smiles, meeting the experimenter's eyes, and again becomes serious: 'Vilya, don't dilly-dally. Hurry up.' The experimenter is called away; Galya says her mummy has come for her, and leaves.

The developed imaginary object situation is always a situation, as well, of the human relations developed in it. A remarkable feature of games with a developed imaginary situation and social relations is precisely that a process arises in them of subordinating the child to rules of action *that arise from the relations established between the players in the game.* Here is an example of such developed play in the middle age group of a kindergarten.

Seven children are playing in a big room. Bobby is the stationmaster. He is wearing a red cap and carries a wooden disc on a stick. He has fenced off a spot with chairs, explaining that this is the station where the stationmaster lives.

Tolya, Lucy, and Lenny are passengers. They have put chairs one behind the other, and have sat down.

Lenny: 'However can we start without a driver? I'll be the engine-driver.' He goes to the front and begins to pant: 'Ssh-ssh-ssh.'

Galya is the buffet waitress. She has fenced off a 'buffet' with chairs around a small table, and put a cardboard box on it into which she has torn bits of paper—'money'. Next to the box she has broken up bits of biscuit and laid them out neatly in rows. 'There, what a well-stocked buffet I've got,' she says.

Babs: 'I'll sell the tickets ... oh, but what is that called?'

'Ticket-clerk,' says the experimenter. Babs: 'Yes, yes, ticket-clerk. Give me some paper.' Having got the paper she tears it into strips, and puts the bigger pieces aside. 'Those are the tickets, and these (the small bits) are money, to give change.'

Bobby comes over to Lenny: 'When I give you this disc, you start immediately.' Lenny chugs, and the passengers take their seats. Suddenly Bobby says: 'Passengers are boarding without tickets and it's time for the train to go.' The passengers run to the ticket-office, where Babs is sitting waiting. They hold out bits of paper to her and she gives them 'tickets' in exchange. The passengers return and take their seats. Bobby comes over and gives Lenny the disc. Lenny chugs and puffs, and they 'start'.

Galya (with a bored look): 'When will they come and buy?' Bobby: 'I can come now; the train's gone and so I can.' He goes over to the buffet and asks for a cake. Galya gives him one and asks: 'What about money?' Bobby runs over to the experimenter, and having received a piece of paper, returns and 'buys' the cake. He eats it with a look of satisfaction. Babs fidgets on her chair, looks at the buffet, but does not leave. Then she looks at the buffet again, and at the experimenter, and asks: 'When do I get to eat? There's nobody here now,' as though justifying herself. Lenny comments: 'What's keeping you? Go ahead.' Babs looks all round, then dashes quickly to the 'buffet', buys hastily, and runs back. Galya rearranges her cakes but does not help herself.

Lenny puffs loudly and shouts: 'Station!' He and the passengers run to the buffet, buy cakes, and return again. Bobby takes the disc from Lenny and then gives it back to him. Lenny puffs and chugs, and again they are 'off'.

Babs goes over to the buffet. At this moment the experimenter comes up to the ticket office and says seriously: 'I want a ticket to Siver Station, but the clerk has gone.' Babs runs back, without managing to buy a cake. 'Here I am, I'm here. I was only gone a minute.' She gives the experimenter a ticket.

Babs goes to the buffet, and buys and eats a cake.

Galya: 'I'd like to eat, too, but what do I do—buy or help myself?' Bobby laughs: 'Buy from yourself and pay yourself.' Galya laughs, but immediately takes two 'kopecks' and buys two bits from herself, explaining as it were

to the experimenter who is present: 'They've already bought once.' Not receiving any reply, she eats.

The experimenter: 'Comrade waitress, someone is asking for you over there.' Galya runs to the door. Lenny jumps down then, and grabs a bit of biscuit, and runs off laughing. Galya, spotting this, screeches and rushes back: 'Why did you help yourself?' Lenny laughs and answers her in this tone: 'You'd gone off somewhere, the buffet was open, nobody was there, so I treated myself.' Everyone laughs, and Galya says in an offended tone: 'You shouldn't have done it. Just the same you shouldn't have stolen anything.' Lenny puffs and chugs. The children 'ride off'. Again there is a halt. They buy cakes. The experimenter says: 'Comrade waitress, they're still asking for you.' Galya says: 'This time I'll take everything with me when I go.' She picks up the bits of biscuit, wraps them in paper, and goes to the door.

The development of such joint games with involved social relations, the most important element of which is the subordination of the child's play behaviour to certain recognised rules of action, is an important precondition for becoming aware of the principle of the play rule itself; on that basis, too, the 'game with rules' proper arises. These are games, whose fixed content is no longer the role and the play situation but the rule and the purpose. Such, for example, is hopscotch; it is necessary to achieve a certain goal set by definite conditions. What are the conditions? They are already quite different play conditions from those we observe in early preschool games; they are nothing else than an external expression, a formulation, of a definite rule.

A remarkable feature of games with fixed rules is that, while any 'role' game already includes a certain rule, 'any game with rules' includes a certain objective. The development of play with rules also consists in greater and greater differentiation and awareness of the play objective.

Awareness of the play purpose makes play activity tend toward a certain result. Does this mean that the game is converted into productive activity because of the appearance of a purpose? Not at all. The game's motive continues, as before, to lie in the play process itself, but that process is now mediated for the child by the purpose. In playing 'tag', for example, it is necessary, not just to run, but to run away

from the one who is 'it'; at the same time the game's motive does not lie at all in avoiding contact with another person, because no game is needed for that; what inspires this game is, as before, the performance of the play process itself; only now, however, its sense consists in its subordination to certain conditions, i.e. in realising a certain purpose (in whose form the game's rule comes out).

Among games with rules and fixed tasks we must note those with a double purpose, which are of great psychological significance (Elkonin). An example is the old Russian game of 'witch's tag' (similar to 'freeze-tag'). The rule of this game is that the 'tagged' child must stand absolutely motionless until the end of the game; it is 'bewitched'. If, however, one of the other players touches it, the 'spell' is removed, and the 'tagged' child again takes part in the game. A running child therefore has two tasks: (1) not to let itself be 'tagged', and (2) to help a 'bewitched' comrade and free him, which cannot be done, of course, except by exposing itself to the risk of being caught.

All these games are of great psychological interest because extremely important traits of the child's personality are developed in them, above all, its ability to subordinate itself to a rule, even when a direct stimulus impels it to do something quite different. Recall the example above of the 'station' game. Babs, playing the part of ticket-clerk, also wanted to 'buy' a cake and eat it; when she had already gone over to the buffet and the desired cake was almost in her hand, the experimenter came up to the 'ticket office' with her, saying 'I want a ticket to Siver Station, but the clerk has gone.' Babs ran back without getting a cake, for it was above all necessary to stick to the 'action rules' directly associated with her play role. It can't be helped; the cakes will wait. Mastering the rule means mastering one's own behaviour, learning to control it, learning to subordinate it to a definite purpose. The purpose comes out here, of course, directly in connection with the play role; it is not yet realised as the principle of the game. The psychological significance of the purpose proper is therefore discovered later in the games we have called those with fixed rules and objectives.

Why are games with objectives psychologically important? Their psychological significance lies in yet another important moment for the moulding of the child personality that arises

in them for the first time, the moment of self-evaluation. The latter arises in a still very simple form, that of evaluating one's dexterity, one's abilities and progress, compared with others. In this play the child is always first who runs faster than the others, or knows how to hide better, while in another game it is Tom or Jackie who is always first, for they are better at meeting the game's requirements. It is from that comparison that the child's independent conscious evaluation of its concrete possibilities and abilities stems. This is not entirely the evaluation it gets from those around it; for the first time, here, it begins to appraise its own actions itself.

Finally, these games with a dual purpose introduce a moment that is essential for the development of a child's psyche. They introduce a moral moment into its activity; in the game of 'freeze-tag', for example, the direct stimulus created by the play situation, namely to avoid whoever is 'it' at any cost, is overcome by the moral motive of helping a comrade. And once again it is important here that this moral moment emerged in the child's activity itself, i. e. actively and, for it, practically, and not in the form of an abstract moral maximum it has heard.

5

To conclude our survey of the development of play in preschool childhood, we must touch on yet another type of game, which might be called borderline games. They stand in fact on the borderline of classic preschool play and are a transitional form of game—transitional either to non-play activity, for which they directly pave the way, or to games characteristic of the school period of the child's psychic development. They are didactic games in the broad sense and dramatisation-games, on the one hand, and sports and improvisation-games on the other hand.

Genuinely didactic games (real games and not preschool exercises) are nothing else than a number of preparatory operations that are involved in the play purpose. They consequently first become possible only when games with objectives arise in general. They are games that train development of the cognitive operations required in the child's subsequent school activity, but are not capable of passing directly

into that activity. Learning does not arise in these games at all, and in general does not arise directly from play; the genesis of this type of activity is determined by the child's whole previous psychic development. Didactic games do not, in essence, lie along the main line followed by the development of the child's psyche. They are of great significance, but a significance subsidiary for all that, a significance which, although very important, is all the same supplementary and not the main condition of psychic development in preschool childhood. Their significance can only be explained by examining a special matter, viz., the development of the preschool child's intellectual operations. We shall not touch specially here as well on sports and games, which already belong in their developed form to the period of school childhood.

In the light of our problem the development of dramatised games, invented and improvised games, and fantasy or daydream games is much more important. These are games that signify the breakdown of play activity in its preschool forms. While remaining play, they are, however, more and more deprived of its inherent motivation. The process of activity psychologically appears to the child in these forms of play simultaneously with the result, the product; the child relates to it as to the product. The motive of these games is consequently, at the same time, shifted more and more to their result.

The developed dramatisation-game is already a kind of 'preaesthetic' activity. Its main attributes are, first, that, unlike role games and early dramatisation, it does not reflect the activity of the depicted personage in a generalised way, but reproduces what is typical of him or her. On the other hand, it is also not direct mimicry or direct imitation; on the contrary, we are dealing here with a deliberate artistic construct guided by some initial idea of the child's. The second main attribute of the true dramatisation-game is that what becomes essential for the child is not only that it is depicting the personage whose role it will play but also how it will play it, how perfectly it will convey the objective content expressed in the role. The dramatisation-game is thus a possible form of transition to productive activity, namely to aesthetic activity with its characteristic motive of the effect on other people.

The fantasy-game is a similar transitional form. An exam-

ple of this play is Tolstoy's beautiful description of children's play with an old carriage. The children gather in an old, abandoned carriage. They sit down in it and 'travel' in their imaginations. In this game there are no actions, no rules, no objectives. Only the external situation, the abandoned carriage, still attests to the origin of the activity. But this is no longer play; it is a reverie, a daydream. The image of the fantasy created in it is a value in itself for the child; it evokes exciting, delightful feelings in the child, who builds this fantasy for the sake of these experiences. The motive of the game has shifted to its product; play has died and the daydream has been born.

We could conclude this outline of the development of play activity with this analysis of these, its last, borderline forms at the time when it is the leading activity for the child's psychic development, but one more essential point remains. We have described a whole number of separate types and forms of preschool play. Are they real stages in the development of children's play?

This point arises because one and the same games can be observed at different ages.

The game 'Chelyuskinites',[3] for instance, can be found at quite different stages of development, but how different its sense is for the child! For tiny tots it is the action itself—sailing on an icebreaker—that is brought out in the game. At a stage higher the outward social relations and social hierarchy of those involved in this Polar epic (who is the chief?), the rules of behaviour of the captain, the chief engineer, the radio operator, etc. come to the fore. Finally, the intrinsic social relations—the moral, higher emotional moments—become the centre. It is quite the same in other children's games; children play similar games at any age, but they play them differently.

Thus, in order to analyse a child's concrete play activity, it is necessary to take the path not of a formal listing of the games that it plays but of penetrating into their actual psychology, in the games' sense for the child. Only then does the development of play emerge for us in its true, inner content.

[3] This game concerns an episode famous in the history of Soviet Polar exploration in 1930s—the west-east voyage of the icebreaker *Chelyuskin*, with women and children on board, along the Arctic coast of Siberia. The ship became trapped in the ice and foundered. The passengers and crew, who had taken to the ice, were rescued by an unprecedented airlift by Arctic pilots. — *Translator's note.*

A CONTRIBUTION TO THE THEORY OF THE DEVELOPMENT OF THE CHILD'S PSYCHE

1

To throw light on the theoretical problem of the motive forces of the development of the child's psyche, we shall first clarify what determines the psychological character of personality at any one stage of its development.

The first point to be made is the following: during a child's development under the influence of the concrete circumstances of its life, the place it objectively occupies in the system of human relations changes.

We shall try and demonstrate this from a description of the real stages through which a child passes in its development.

Preschool childhood is the time of life when the world of human reality around a child is opening up more and more to it. In its activity, and above all in its games, which have now got beyond the narrow limits of manipulating the objects around it and of contact with the persons directly around it, a child penetrates a wider world, assimilating it in an effective way. It assimilates the object world as a world of human objects, reproducing human actions with them. It drives a 'car', aims a 'gun', although it is impossible really to ride in its car or to shoot with its gun. But at this time in its development that is immaterial to it, because its basic vital needs are met by adults regardless of the objective productiveness of its activity.

A child experiences its dependence on the persons directly around it; it has to reckon with the demands those around it make on its behaviour, because that really determines its intimate, personal relations with them. Not only do its successes and failures depend on those relations, but its joys and sorrows are also involved in them, and they have the force of a motive.

During this period of a child's life the world around it breaks down for it, as it were, into two groups. One group consists of the persons intimately close to it, relations with whom determine its relations with all the rest of the world;

these are its mother, its father, or those who take their place for the child. A second, wider circle is formed by all other persons, relations with whom, however, are mediated for it by the relations it has established in the first, smaller circle. And that is not simply so when it is brought up in a family. Assume that a preschool child that has been raised in a family is put into a kindergarten. Its mode of life seems to change radically and to some extent that is true, but psychologically its activity remains as before within its basic, very important limits.

We all know how unique the relations of children of this age with the nursery-school teacher are, how necessary her personal attention is for them, and how often they have recourse to her mediation in their relations with coevals. Relations with her may be said to form part of the small, intimate circle of the children's contacts.

A child's relations within a group of children are also peculiar. What links children of three to five stably with one another is still largely the personal, the 'private' so to speak, element in their development leading to a real group spirit. In this the teacher plays the main role—once again by virtue of her personal relations with the children.

When we look closely into all these features of the preschool child, it is not difficult to discover the general basis connecting them. This is the child's real position, from which the world of human relations unfolds before it, a position that is governed by the objective place it occupies in these relations.

A six-year-old may be able to read excellently, and in certain circumstances its knowledge may be relatively great. That, however, does not and cannot in itself erase the childish, the truly preschool element in it. On the contrary, something childish colours all its knowledge. When it happens, however, that a child's basic life relations are restructured, when, for example, it has a little sister on its hands, and its mother treats it as her helper, a participant in adult life, the whole world then opens up in a quite different way. It does not matter that it still knows little and understands little; the quicker it gives what it knows a new meaning and the quicker its general psychic character will change.

In normal cases the transition from preschool childhood to the next stage in the development of psychic life occurs in connection with a child's enrolment in school.

It is difficult to exaggerate the significance of this event in a child's life. The whole system of its relations is reorganised. The essential point is not, of course, that the schoolchild is obliged in general to do something; it had duties even before entering school. The essential point is that there are now not just duties to parents and teachers, but are objectively obligations to society. They are duties on whose fulfilment its place in life, its social function and role, and hence also the content of all its subsequent life, depend.

Is the child conscious of this? It knows about it, of course, and usually, moreover, long before it goes to school. But these demands acquire real, psychologically effective sense for it only when it begins to study; at first, moreover, they still emerge in a very concrete form, namely in the form of the demands of the teacher and the school head.

Now, when a child sits down to prepare its lessons, it perhaps feels itself, for the first time, to be occupied with a really important matter. At home the little ones are forbidden to bother it, and even adults at times sacrifice their own affairs in order to give it the chance to work. This is quite different from its previous games and occupations. The very place of its activity in the adult, 'truly real' life around it has become different.

A child may or may not be bought a toy, but it is impossible not to buy it a textbook or an exercise book. The child therefore requests a schoolbook to be bought for it quite differently to how it asks for a toy to be bought. These requests have a different sense not only for its parents but above all for the child itself.

The main point, finally, is that now the child's intimate relations lose their previous determinant role in the broader circle of its contacts; they themselves are now determined by these broader relations. However good the intimate, 'homely' relations are that the child feels for itself, a bad mark from the teacher, for example, inevitably casts a shadow on them. It is all quite different from what it was previously, before school. It is quite different from a complaint by the kindergarten teacher. The mark itself crystallises the new relations, as it were, and the new form of contact that the child has entered into.

Nothing in its behaviour can be allowed to anger the school teacher: you may not bang the top of your desk, not even once, and not talk with a neighbour during a lesson;

and you may try very, very hard really to win the teacher's favour, yet all the same she will give you a poor mark for writing the names of flowers and birds with a capital letter in the dictation test, even when you give her the argument that everyone at home and at kindergarten accepted: 'I didn't do it on purpose', 'I didn't know', 'I thought it was right'. This is what we adults call the objectivity of the school mark.

Furthermore, let the pupil even understand later that neither 'rose' nor even 'sun' is written with a capital letter, and even if it gets a good mark, even a top one, at the next dictation test, and even if the teacher praises it for its progress, the bad mark received still does not disappear from the exercise book or from the school report card, because of that; the new mark goes down next to it, not in place of it.

The transition to the next stage in the development of a child's life and consciousness takes place with the same inner pattern. For the teenage pupil this transition is associated with its inclusion in the forms of social life available to it (involvement in certain social undertakings that are not of a specially child character; the Young Pioneer organisation; a new content in hobby circles). At the same time, the real place that the child occupies in the everyday life of the adults around it and in the family's affairs also alters. Now its physical powers and its knowledge and abilities sometimes put it on an equal footing with adults, and it even feels its superiority to something or other; a boy is sometimes the recognised fixer of appliances, is sometimes the strongest person in the family, stronger than his mother and sisters, and is called on for help when a man is needed, and sometimes he is the main home commentator on public events.

From the aspect of consciousness this transition to senior school age is marked by growth of a critical attitude toward adults' demands, behaviour, and personal qualities and the birth of new, for the first time truly theoretical, interests. A need arises in the senior pupil to know not only the reality around it but also what is known about this reality.

At a first, superficial glance it may seem that there are no changes in the place occupied by a schoolchild in the system of human relations at the end of the period of childhood and youth, and with its transition to a job. But that is only

outwardly. The youth who today is simply a diligent beginner, proud and satisfied in his consciousness of being a worker, tomorrow becomes one of the enthusiasts of advanced production. While remaining a worker, he now occupies a new place, his life has acquired a new content, and that means that he comprehends the whole world in a new way now.

The change in the place a child occupies in the system of social relations is thus the first thing that needs to be noted when trying to find an answer to the question of the driving forces in the development of its psyche. This place, however, does not in itself, of course, determine development; it simply characterises the existing stage already achieved. What directly determines the development of a child's psyche is its life itself, and the development of the real processes of this life, in other words, the development of the child's activity, both outward and inner. But its development in turn depends on its actual living conditions.

In studying development of the child psyche, we must therefore start by analysing the development of the child's activity, as this activity is built up in the concrete conditions of its life. Only with such an approach can the role both of the external conditions of its life and of the potentialities it possesses be elucidated. Only with such an approach, based on analysis of the content of the child's developing activity itself, can the leading role of education and upbringing operating precisely on its activity and its attitude to reality, and therefore determining its psyche and its consciousness, be properly understood.

Life or activity as a whole is not built up mechanically, however, from separate types of activity. Some types of activity are the leading ones at a given stage and are of greater significance for the individual's subsequent development, and other types are less important. Some play the main role in development and others a subsidiary one. We must therefore speak of the dependence of the psyche's development on the leading activity, and not on activity in general.

We can say, accordingly, that each stage of psychic development is characterised by a definite relation of the child to reality that is the leading one at that stage, and by a definite, leading type of its activity.

The criterion of the transition from one stage to another is precisely the change in the leading type of activity, in the child's leading relation to reality.

What is this 'leading type of activity'?

Purely quantitative indices are by no means the criterion of leading activity. The leading activity is not simply the one most often encountered at a given stage of development, the activity that a child devotes much of its time to.

We call leading activity that activity of a child that is characterised by the following three attributes.

(1) It is the activity in whose form other, new types of activity arise, and within which they are differentiated. For example, instruction in the narrowest sense of the term, which first develops already in preschool childhood, arises first in play, i. e. precisely in the leading activity of that stage of development. The child begins to learn by playing.

(2) Leading activity is the activity in which particular psychic processes take shape or are reorganised. The child's processes of active imagination, for example, are moulded first in play, and the processes of abstract thinking in studies. It does not follow from this that the moulding or restructuring of all psychic processes takes place only within the leading activity. Certain psychic processes are not directly shaped and reorganised in the leading activity itself but in other forms of activity genetically linked with it. The processes of abstracting and generalising colour, for example, are not moulded in preschool childhood first in play itself, but in drawing, colour appliqué work, etc., i. e. in forms of activity that are only associated with play activity in their source.

(3) Leading activity is the activity on which the main psychological changes in the child's personality observed at a given period of development depend in the closest way. It is precisely in play that the preschool child, for example, assimilates people's social functions and appropriate standards of behaviour ('What is a Red Armyman?', 'What does the director, the engineer, the worker do in a factory?'), and this is a very important moment of the moulding of its personality.

Leading activity is therefore the activity whose development governs the chief changes in the psychic processes and psychological features of the child's personality at a given stage of its development.

The stages of development of the child's psyche, however, not only have a definite content in its leading activity but

also a certain sequence in time, i. e. a definite link with children's age. Neither the content of the stages nor their time sequence, however, is given once and for all and immutable.

The point is that both each new generation and each individual belonging to a given generation has certain, already given conditions of life which also make the content of its activity, whatever it is, possible. Therefore, although we note a certain stadial character in the development of the child's psyche, the content of the stages, however, is by no means independent of the concrete, historical conditions in which the development takes place. It is on these conditions that it primarily depends. The concrete, historical conditions make their influence felt both in the concrete content of an individual stage of development and in the whole course of the psychic development process as a whole. The duration and content of the period of development, for example, that is a person's preparation, as it were, for his involvement in social and work life, i. e. the period of upbringing and training, are historically far from always the same. Its duration varies from epoch to epoch, lengthening as society's requirements made in that period grow.

Hence, although the stages of development are also spread over time in a certain way, their age limits, however, depend on their content, and that in turn is governed by the concrete, historical conditions in which the child's development is taking place. Thus, it is not the child's age as such that determines the content of a stage of development; the age limits of a stage themselves, on the contrary, depend on its content and alter *pari passu* with the change in the socio-historical conditions.

These conditions also determine what activity of a child precisely will become the leading one at a given stage in the development of its psyche. Mastery of the object reality immediately surrounding it, and the play in which it assimilates a broader round of phenomena and human relations, systematic study at school, and further special training or work—such is the succession of the leading activities and leading relations that we can note in our time and in our Soviet conditions.

What relations precisely link the child's leading type of activity and the real place it occupies in the system of

social relations? How are the changes in this place and in the child's leading activity linked together?

The answer to that, in its most general form, is that the child begins to realise in the course of development that the place it used to occupy in the world of human relations around it does not correspond to its potentialities, and strives to alter it.

An open contradiction arises between the child's mode of life and its potentialities, which have already outstripped this way of life. Its activity is reorganised accordingly, and it thus passes to a new stage in the development of its psychic life.

By way of example we can take cases of a child's 'outgrowing' of its preschool childhood. At first, in the junior and middle group of kindergarten, it joins in the group's life eagerly and with interest, and its games and occupations are full of sense for it; it eagerly shares its achievements with its seniors, shows its drawings, recites verses, and tells about the events on an ordinary walk. It is not embarrassed in the least that adults listen to it with a smile, with half an ear, frequently not paying proper attention to all the things that are important to it. For it itself they have sense, and that is enough for them to fill its life.

A certain time passes, however, and the child's knowledge increases, its capacities become greater, and its powers grow, and as a result activity in the kindergarten loses its former sense for it, and it more and more 'drops out' of the kindergarten's affairs. Or rather, it tries to find a new content in them; groups of children form who begin to live their own, special, hidden, no longer 'preschool' life, the street, the courtyard, the society of older children become more and more attractive. The child's self-assertion more and more often takes on forms that infringe discipline. This is what is known as the seven-year-old crisis.

If a child remains out of school for another whole year and is treated at home as before as a little one, and is not drawn properly into the family's workaday life, this crisis can become extremely acute. The child lacking social obligations finds them for itself, perhaps in quite abnormal forms.

These crises—the three-year-old crisis, the seven-year-old crisis, the adolescent crisis, the youth crisis—are always associated with a change of stage. They indicate in clear, obvious form, that these changes, these transitions from one

stage to another have an inner necessity of their own. But are these crises inevitable in a child's development?

The existence of development of crises has long been known and their 'classic' interpretation is that they are caused by the child's maturing inner characteristics and the contradictions that arise on that soil between it and the environment. From the standpoint of that interpretation the crises are, of course, inevitable because these contradictions are inevitable in any conditions. There is nothing more false, however, in the theory of the development of a child's psyche than this idea.

In fact crises are not at all inevitable accompaniments of psychic development. It is not the crises that are inevitable but the turning points or breaks, the qualitative shifts in development. The crisis, on the contrary, is evidence that a turning point or shift has not been made in time. There need be no crises at all if the child's psychic development does not take shape spontaneously but is a rationally controlled process, controlled upbringing.

In ordinary cases the change of leading type of activity and the child's transition from one stage of development to another correspond to an inner need that is arising and occur in connection with the child's being faced by education with new tasks corresponding to its changing potentialities and new awareness.

2

How does the change of leading activity take place on this basis?

To answer that we must first, as a preliminary, differentiate between two concepts: namely, activity and action.

We do not call every process activity. By this term we mean only those processes which, by realising man's relations with the world, meet a special need corresponding to it. We do not properly call such a process as, for example, remembering, activity, because it does not, as a rule, in itself, realise any independent relation with the world and does not meet any special need.

By activity we mean processes that are psychologically characterised by what the process as a whole is directed to

(its object) always coinciding with the objective that stimulates the subject to this activity, i. e. the motive.

Let us explain this by an example. Let us assume that a student, preparing for an examination, reads a book on history. Is that psychologically a process that we have agreed to call activity proper? We cannot say immediately, because the psychological character of the process requires us to say what it represents for the subject himself. And to do that we already need a psychological analysis of the process itself.

Let us assume that our student's comrade came to him and told him that the book he was reading was not necessary at all for the examination. The following might then happen: the student would either immediately lay the book aside or continue to read it, or perhaps he would give up reading it reluctantly, with regret. In the last two cases it is obvious that what had directed the reading process, i.e. the content of the book, had in itself stimulated the reading, had been the motive. In other words some special need of the student's had found satisfaction in mastering its content—a need to know, to understand, to comprehend that which the book was about.

The first case is another matter. If our student, on learning that the content of the book was not in the syllabus of the test, readily stops reading it, it is clear that the motive inducing him to read it was not the content of the book *per se* but only the need to pass the examination. What his reading was directed to did not coincide with what induced him to read. In this case, consequently, the reading was not properly activity. The activity here was preparing for the examination and not the reading of the book *per se*.

Another important psychological feature of activity is that a special class of psychic experiences—emotions and feelings—is specifically linked with it. These experiences do not depend on separate, particular processes but are always governed by the object, course, and outcome of the activity they form part of. The feeling with which I walk along the street, for example, is not determined by my walking, and not even by the external conditions I have been forced to go out in, or whether I shall encounter some obstacle in my way, but depends on what vital relation is involved in my action. In one case, therefore, I may walk happily in cold rain, and in another grow inwardly numb

in good weather; in one case a hold-up en route puts me in despair, in the other even an unforeseen obstacle forcing me to return home can make me inwardly happy.

We distinguish the process we call action from activity. An act or action is a process whose motive does not coincide with its object (i.e. with what it is directed to), but lies in the activity of which it forms part. In the case of reading cited above, when it is continued only until the student realises it is not necessary for passing the examination, the reading is precisely an action. For what it is directed to *per se* (mastery of the book's content) is not its motive, is not what induced the student to read it, but rather the need to pass the examination.

Because the object of an action does not itself prompt to act, it is necessary for action to arise and to be accomplishable, for its object to appear to the subject in its relation to the motive of the activity of which it forms part. This relation is also reflected by the subject, moreover, in a quite definite form, namely in the form of awareness of the object of the action as a goal. The object of an action is therefore nothing other than its recognised direct goal. (In our example the aim of reading the book is to master its content, and that direct goal has a certain relationship to the motive of the activity, i.e. to passing the examination.)

There is a particular relation between activity and action. The motive of activity, by being shifted, may pass to the object (goal) of the action, with the result that the action is transformed into an activity. This is an exceptionally important point. This is the way new activities and new relations with reality arise. This process is precisely the concrete, psychological basis on which changes in the leading activity occur and consequently the transitions from one stage of development to another.

What does the psychological 'mechanism' of this process consist in?

To explain that let us first pose the general question of the genesis of new motives, and only then that of the transition to motives creating a new leading activity. Let us turn to the analysis of a concrete example.

Assume that a pupil in the first class cannot be made to do its lessons. It tries to put off preparing them in every way, and is distracted by extraneous things almost as soon

as it has begun. Does it understand, does it know, that it has to prepare the lesson, that otherwise it will get a bad mark, that that will vex its parents, and finally that it is its obligation in general, its duty, to study, and that unless it does so it will never become a really useful person for its country, etc., etc.? A well developed child knows all that, of course; nevertheless it is not enough to make it do its lessons.

Suppose now that the child is told: 'You won't go out to play until you've done your lessons.' Let us assume that that does the trick and that the child does the homework it was set.

In this case we observe the following state of affairs: the child wants to get a good mark and wants to do its duty. These motives indisputably exist in its consciousness, but are not psychologically effective; another motive, however, is really effective, namely to get permission to go out and play.

Let us call the first type of motive 'only understandable motives' and the second kind 'really effective motives'.[1] Bearing this distinction in mind, we can now advance the following proposition: 'only understandable motives' become effective ones in certain conditions, and that is how new motives arise and consequently new types of activity.

The child begins to do its homework under the influence of a motive that we have created specially for it, but a week or two pass and we see that it itself already sits down to its homework of its own volition. Once, while copying something out, it suddenly stops and leaves the table, crying. 'Why have you stopped working?' it is asked. 'What's the good,' it explains, 'I'll just get a pass or a bad mark; I've written very untidily.'

This case reveals a new effective motive for its homework. It is doing its lessons now because it wants to get a good mark. And it is in just that that the true sense of the copying out consists for it, or the solving of a problem, or the performance of other study acts.

The really effective motive inducing the child to do its homework now is a motive that was previously 'only understandable' for it.

[1] A similar distinction was made by Myasischev (1936). In adopting it, however, we introduce a rather different nuance and therefore also employ different terms.

How does this transformation of motive come about? The question can be simply answered. It is a matter of an action's result being more significant, in certain conditions, than the motive that actually induces it. The child begins doing its homework conscientiously because it wants to go out quickly and play. In the end this leads to much more; not simply that it will get the chance to go and play but also that it will get a good mark. A new 'objectivation' of its needs comes about, which means that they are understood at a higher level.[2]

The transition to a new leading activity differs from the process described simply in the really effective motives becoming, in the case of a change of leading activity, those 'understandable motives' that exist in the sphere of relations characterising the place the child can occupy only in the next, higher stage of development, rather than in the sphere of relations in which it still actually is. The preparation of these transitions therefore takes a long time, because it is necessary for the child to become quite fully aware of a sphere of relations that are new for it.

In cases when the development of a new motive does not correspond to the real possibilities of the child's activity, this activity may not arise as a leading one, and initially, i.e. at this stage, will develop along a secondary line, as it were.

Let us assume, for example, that a preschool child masters dramatising in the course of play and then takes part in a children's fête to which its parents and other adults are invited. Let us also assume that the result of its creation has a certain success. If the child understands this success as related to the result of its actions, it begins to aspire to objective productiveness of its activity. Its creation, previously governed by play motives, now begins to develop as a special activity already distinguished from play. But the child may still not become an artiste, however. The shaping of this new activity, productive in character, therefore has no significance in its life, the lights of the fête are

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[2] Does the art of upbringing and education not consist in general in creating a proper combination of 'understandable' and 'really effective' motives, and at the same time in knowing how, in good time, to attach greater significance to the successful result of activity so as to ensure a transition to a higher type of the real motives governing the individual's life?

extinguished and the child's success in dramatising no longer evokes the old attitude of those around; so no shifts take place in its activity, and a new leading activity does not arise on this basis.

It is quite different when study is converted in like manner into independent activity. This activity, which has a new type of motivation and corresponds to the child's real potentialities, is now stabilised. It determines the child's life relations in a stable way and, developing at an intensified rate under the influence of the school, outstrips the development of the child's other types of activity. The child's new acquisitions and its new psychological processes therefore arise for the first time in precisely this activity, which means that it begins to play the role of a leading activity.

3

A change in leading activity provides the basis for further changes characterising the development of the child's psyche.

What are these changes?

First of all, let us touch on the changes in the psychological character of actions.

For an action to arise it is necessary for its object (direct aim) to be cognised in its relation with the motive of the activity of which it forms part. That is an extremely important point. It follows from it that the aim of one and the same act can be cognised differently, depending on what motive precisely it arises in connection with. The sense of the action thus also changes for the subject.

Let us clarify that with an example.

Assume that a child is occupied in doing its homework and is solving a problem set it. It is conscious of the aim of this action, of course, which is, for it, to find the required answer and to write it down. And its action is directed precisely to that. But how is the aim recognised, i.e. what sense does this action have for the child? To answer that we must know what activity of the child's the action forms part of or, what is the same thing, what the action's motive is. It may be that the motive here is to learn arithmetic; it may be not to make the teacher angry; and finally, perhaps, it is to get a chance to go play with comrades. Objec-

tively the aim in all these cases remains the same, to solve the given problem. But its sense for the child will be different each time, so that its actions themselves will, of course, be psychologically different.

Depending on what activity the action forms part of, it will have one psychological character or another. That is a basic law of the development process of actions.

Let us take the following example. A preschool child answers a question put to it, and a first-year schoolchild answers the same question put to it by its teacher. With an answer of the same content, how different, however, their speech may be! Where is the child's old naturalness of speech? The classroom answer is an act that is not motivated by the teacher's needing to be told about something, or by sharing something with her. It includes a new relation and realises another activity, that of learning.

The teacher asks: 'How many windows are there here, in the classroom?' And she herself looks at the windows. All the same it is necessary to say: 'There are three windows.' One must say that a forest is depicted in a picture, though both the teacher and the whole class can see that it is a forest. 'For the teacher does not ask questions just to make conversation'—that is how a first-year pupil explained the psychological situation arising in a lesson. And that is just it; it is 'not for talk'. And therefore the child's speech in a lesson is structured differently psychologically than its speech in play and in its verbal contacts with schoolfellows, parents, etc.

The child's awareness, i.e. its interpretation, of the phenomena of reality equally occurs in connection with its activity. At each stage of its development it is limited by the round of its activity, which depends in turn on the leading relation and the leading activity, which is precisely why it also characterises this stage as a whole.

That statement calls for a certain clarification. It is a matter here precisely of awareness, i.e. of what personal sense a phenomenon has for the child, and not of its knowledge of the phenomenon. To explain that I shall employ an example I have already used elsewhere. One may know some historical event quite well, and very well understand the significance of some historical date, but this date may at the same time have a different sense for a person—one for a youth who has not yet quit the school form, another for

the same youth who is fighting on the battlefield, ready, if necessary, to lay down his life for it. Has his knowledge of this event, of this historical date, changed or been increased? Not at all. It may even be a little less distinct, something perhaps even forgotten. But for some reason he has remembered this event, it has come to mind, and it turns out that another light has been thrown on it in his mind, and its content has been more fully disclosed as it were. It has become different, but not from the aspect of knowledge of it but from the angle of its sense for the individual; it has acquired a new sense. A truly meaningful and not formal description of a child's psychological development therefore cannot be abstracted from the development of its actual attitude to the world and from the content of its relations; the description must start precisely with an analysis of these relations and attitudes, because it is impossible otherwise to understand the features of the child's consciousness.

The justice of that will be readily seen, for example, if we try to give a psychological description of seven-year-old children going to school for the first time. What strikes the psychologist's eye here? An unusually marked difference between the children if he regards the processes of their upbringing and thinking abstractly, especially their speech. But the psychological image of a seven-year-old—the truly general one that characterises a child of seven—is not just created by these processes taken separately, but also by the psychological features of their activity in school, the attitude to the teacher, lessons, and classmates, typical of them, and hence also already only what characterises the separate partial processes of psychic life, i.e. how the children perceive the study material, how they understand explanations, how they structure their speech when answering the teacher, and so on.

Thus any conscious act is moulded within an established round of relations, within some activity or other that also determines its psychological peculiarity.

Let us turn to the next group of changes observed during a child's development, namely changes in the field of operations.

By operations we mean the mode of performing an act. An operation is the necessary content of any action but it is not identical with the latter. One and the same action

may be performed by different operations, and conversely, one and the same operation may sometimes realise different actions. That is because an operation depends on the conditions in which the action's goal is given, while an action is determined by the goal. If we take a quite simple example, we can clarify this in the following way: let us assume that I have conceived the aim of memorising verses; my action will then consist in my active memorising of them. But how shall I do this, however? In one case, for example if I am sitting at home at the time, I will prefer, perhaps, to write them down; in other conditions I will resort to repeating them to myself. In both cases the action will be memorising, but the means of doing it, i.e. the operations of memorising, will be different.

More precisely, the operation is determined by the task, i.e. the goal, given in conditions requiring a certain mode of action.

Let us consider only one type of operation, viz., conscious operations.

For conscious operations to develop it is typical (as experimental studies have shown) that they are formed first as actions, and cannot otherwise arise. Conscious operations are formed at first as goal-directed processes that only later may acquire the form, in some cases, of an automatic habit.

How then is an action converted into an operation, and consequently into a skill and habit? To convert a child's action into an operation, the child has to be presented with a new aim with which its given action will become the means of performing another action. In other words, what was the goal of the given action must be converted into a condition of the action required by the new aim.

Let us take an example. When a tiro hits the target during practice on a rifle range, he performs a definite act. What are its features? First of all, in the activity it forms part of, in what its motive is, and consequently in what sense it has for him. But it is also characterised by something else, by the means and techniques by which it is performed. Aimed shooting calls for a host of processes, each of which meets certain conditions of the action. It is necessary to put the body into a certain position, to hold the rifle's foresight strictly upright, to take aim properly, to press the butt into the shoulder, to hold the breath, and to squeeze

the trigger quickly to the initial release point, and gradually to increase the finger's pressure on it.

In the trained marksman none of these processes is an independent action. The goals corresponding to them are not differentiated each time in his consciousness. In his consciousness there is only one goal, to hit the target. This also means that he has fully mastered the knack of shooting and the motor operations required for it.

It is quite different with one who is only just learning to shoot. He must first learn to hold the rifle properly, and to make that his goal; his action consists in that. Then his next action is to take aim, and so on.

By tracing the process of learning to shoot as a whole, we can very readily see the basic laws of the connection between operations and action.

First of all, it proves that it is actually impossible to teach any separate technique, i.e. any shooting operation, without first making it a special purposeful process for the tiro, namely an action. Later, it becomes clear, as well, how to convert this action into an operation. After the tiro has learned, for example, to squeeze the trigger smoothly, he is given a new task, to fire at the target. Now the aim in his consciousness is not 'to squeeze the trigger smoothly' but another one, to 'hit the target'. Smoothness in pressing the trigger is now only one of the conditions of the action required by this goal.

It is essential, moreover, to note that the previous, necessarily conscious moments of holding the rifle properly, pressing the trigger, etc. have now stopped being done consciously. But that does not mean at all that the marksman does not also perceive them. It is, of course, not at all so. He not only continues to perceive all these moments (e.g. the relation of the sights, the pressure of the rifle butt against his shoulder, etc.) but his movements continue to be controlled by their perception. At any moment he may also become conscious of them, so that an impression is also created that they are psychically reflected in exactly the same way as the goal of the action.

This link between action and operations, demonstrated by the example of motor movements, also holds for mental operations and their reinforcement in the form of mental habits. Addition, for example, can be both an action and an operation. To begin with, a child masters it as a definite operation,

the means for which (i.e. the operation) is counting by ones. But later it is given problems whose conditions require numbers to be added ('to find out so and so it is necessary to add such and such numbers'). The child's mental action must then become the solution of a problem and not just addition; the addition becomes an operation and must therefore acquire the form of an adequately developed and automatic habit.

So far, in speaking of the development of operations, we have mainly stressed one aspect, viz., their formation in the course of an action and their dependence on an action. But, as will already have been seen from the examples given, there is also another link between the development of operations and of actions; when the level of development of operations is high enough it becomes possible to pass to the performance of more complicated actions, and these more complicated actions in turn may provide the basis for new operations preparing the possibility for new actions, and so on.[3]

The last group of changes during the psyche's development on which we shall touch is those in psychophysiological functions.

By this term we mean physiological functions that realise the higher form of the organism's life, i.e. its life mediated by psychic reflection of reality. The group includes sensory functions, the mnemonic function, tonic function, and so on.

No psychic activity can be performed without involvement of these functions, but it does not consist solely in them and cannot be derived from them.

All these functions constitute the basis, as well, of the corresponding subjective phenomena of consciousness, viz., sensations, emotional experiences, sensory phenomena, and memory, which form the subjective 'matter of consciousness', as it were, the sensual richness, the polychromism and plasticity of the picture of the world in man's consciousness.

If we mentally exclude the function of colour perception, the image of reality in our consciousness will acquire the paleness of a black-and-white photograph. If we block our hearing our picture of the world will be as poor as a silent

[3] We ignore the question here of the inner link between mental operations and the categories of consciousness (i. e. meanings and concepts) corresponding to them. The complexity of this problem calls for special consideration.

film is compared with a sound one. On the other hand, however, a blind person can become a scientist and create a new, more perfect theory of the nature of light, although he can experience light sensually just as little as an ordinary person can sense the velocity of light. This signifies that, although sense phenomena and concepts, meanings are interrelated, psychologically they are different categories of consciousness.

What does the development of functions consist in, in their connection with the processes of reality? As research has indicated, any function develops and is restructured within the process that it realises. Sensations, for example, develop in connection with the development of processes of goal-directed perception. That is why they can be actively cultivated in a child, and their cultivation cannot, moreover, by virtue of that, consist in simple, mechanical training of them, in formal exercises.

We now have a considerable number of experimental findings at our disposal, obtained by various workers, that undoubtedly demonstrate the dependence of the development of functions on the concrete process in which they are involved.[4] Our own research has made it possible to make that more precise and to establish that shifts in the development of functions occur only when the function has a definite place in activity, namely if it is so included in an operation that a certain level of its development becomes necessary for performance of the corresponding action. In that case the limits of possibility of shifts, in particular in the field of sensory functions, i.e. sensitivity, proves to be extremely wide, so that the 'normal' values of thresholds established by classical psychophysics may be considerably surpassed. When visual estimation is being investigated, for example, a shift toward a lowering of established average thresholds of more than two-thirds was obtained in these conditions; in investigations of variations in the threshold of estimating weight, the shift was more than half, and so on. And our findings are by no means the limit.

When we pass from these laboratory facts, obtained with adults, to examination of the facts of children's development, the forming of what is called phonematic hearing in

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[4] See: B. M. Teplov. Capacities and Talent. In: *Uchonye zapiski instituta psikhologii*, 1941, Vol. 2.

a child can serve as an adequate illustration of what has been said. During its development a child as we know acquires a capacity to differentiate phonemes extremely finely, i.e. the meaningful sounds of the language, but just because their differentiation is a necessary condition for distinguishing between words that are similar in sound but different in meaning. The distinguishing of sounds whose differences are not a real means for the child to distinguish between words by meaning remains much less perfect. Later, consequently, when it begins to study a foreign language, it does not at first hear the difference at all between similar phonemes that are new to it, like the difference, for example, between the French vowel sound in *mais* and *mes*. It is remarkable, moreover, that it is not enough, in order to become sensitive to this difference, to listen to spoken French often, without trying, however, to master it. That is why it is possible to spend many years among people speaking another language and to remain deaf all the same to the nuances of its phonetics.

There is also a reverse connection between the development of functions and that of activity; the development of functions in turn makes it possible to perform the corresponding activity better. A fine distinction between shades of colour, for instance, is often the result of undertaking such an activity as embroidery, but it in turn facilitates an even finer choice of colour for embroidery, i.e. makes it possible to perform this activity better.

The development of a child's psychophysiological functions is thus also naturally connected with the general course of its activity's development.

4

To conclude our essay we shall touch on the general dynamics of the development of a child's psychic life and once again summarise certain basic propositions that we have put forward.

Let us first picture the changes as a whole that characterise a child's psychic development within the limits of a stage.

The first and most general point that can be advanced here is that the changes observed in the processes of a child's

psychic life within the limits of each stage do not occur independently of one another but are internally linked with each other. In other words, they are not independent lines of development of separate processes (perception, memory, thinking, etc.). Although these lines of development can also be separated, it is impossible, when analysing them, to find the relations directly that foster their development. The development of memory, for example, of course forms a connected series of changes, but their necessity is not determined by the relations arising within the development of memory itself, but by relations that depend on the place memory occupies in the child's activity at a given stage of its development.

At the stage of preschool childhood, for instance, one change in memory is that volitional remembering and recall are formed in a child. The preceding development of memory is a necessary precondition for this change to be possible, but it is not determined by it; rather it is determined by special goals—to remember, to recall—being differentiated in the child's consciousness. In that connection the place of memory processes in the child's psychic life is altered. Before memory emerged only as a function serving some one process; now remembering becomes a special, purposeful process, an inner action, occupying a new place in the structure of the child's activity.

We observed this conversion of remembering and recall into a special action in our special experiments with preschool children.

During a group game, the child performing the 'liaison' role had to transmit a message to 'H.Q.' consisting always of the same initial sentence and several suitably selected names of different objects (each time different, of course).

The smallest children who took on the liaison role did not understand its inner content. Their role appeared to them solely in its external, procedural aspect, viz., to run to 'H.Q.', to salute, etc. The inner procedural aspect, however, i.e. the ensuring of contact, transmission of the message, etc. did not seem to exist for them. More often than not they therefore ran off every time to carry out the mission without even hearing it out.

Other children also accepted the inner procedural content of the role. They were also anxious really to pass on the message, but at first did not single out the aim of memorising

its content. Their behaviour therefore also presented a peculiar picture; they listened to the assignment but clearly did nothing in order to remember it. In passing the message on they did not make any active attempt to recall what they had forgotten. And when asked what else there was to pass on, they usually answered: 'Nothing. That's all.'

The older children behaved differently. They not only listened to the message but also tried to memorise it. This was sometimes expressed in their moving their lips while listening to the message, or in repeating it to themselves on the way to 'H.Q.' If an attempt was made to speak to them while they were running with the message, they shook their heads and hurried on their way. In transmitting the message these children did not simply 'blurt' it out, but tried to recall what they had forgotten: 'Now I'll tell you more ... now ...'. They were evidently doing something internally, were trying to find what was necessary somehow in their memory. Their inner activity was also directed to a definite aim in this case, viz., to remember the content of the message.

Such were the initial facts. The experiment proper consisted in trying to single out a special goal in their consciousness, viz., to remember, by putting special demands on subjects who were unable to remember actively, and by giving them supplementary instructions and so stimulating them to volitional remembering.

It proved necessary, for the aim of remembering to arise subjectively before a child, for the activity that included the corresponding objective task to acquire a motive that could communicate a sense of remembering to the child. In the experiments described this was achieved by passing from a motive that consisted in mastering the external aspect of a role, to one of mastering its inner content. A simple request to the child to 'try and remember' did not change anything in this aspect of its behaviour.

In this case we observed the genesis of remembering as an action during the development of play activity, but it could, of course, have taken shape in some other activity of the child's.

The last point that we would note in connection with the findings of our research relates to the conversion of remembering, as a volitional, conscious act into a conscious operation.

We found that the process of transforming a mental act difficult for a child, i.e. remembering, into an operation did not begin immediately by any means and that it was sometimes only completed with the transition to school education.

How is that to be explained?

An action, on being converted into an operation, is reduced as it were in the rank it occupies in the general structure of activity, but that does not mean that it is simplified. In becoming an operation it falls out of the round of conscient processes, but retains the general features of a conscious process, and at any moment, for example with a difficulty, may again become conscious. That is also the explanation of why, when we are dealing with the development of processes that are new in form (and such is volitional remembering in preschool childhood), a quite long transition is observed characterised by the process's existing as an action but not as an operation. Therefore, when a child is given a special goal—to remember—the memorising and correspondingly the recall have the character of a volitional, controlled process for it. When this goal is not singled out, but is overshadowed by another one being posed at the same time, memory will again acquire features of involuntariness.

In this respect observations of the memory of seven-year-old schoolchildren are very much to the point; at the beginning of their school life they often 'forget' what they have been set, i.e. are unable voluntarily to remember it at the required moment. The specific tendency of children in their first days in the classroom leads to the special objective, viz., to remember the lesson, easily slipping from their memory, while volitional remembering in the form of an operation, i.e. 'secondary' volitional memory (by analogy with the commonly used term 'secondary, volitional attention'), still does not exist in many children of this age. As a result it happens that a child is wholly concentrated, on the one hand, on the school's demands (who does not know how solemnly the new pupil relates to the teacher's instructions, and to what an extent these are unquestionable for it), and on the other hand cannot remember what it has been set to do.

Everything we have said gives grounds for characterising the general picture of the development of the sepa-

rate processes in a child's psychic life within a stage as follows. The development of the leading activity that characterises a given stage, and the development of other forms of the child's activity connected with it, determine the singling out of new goals in its consciousness and the forming of new actions answering to them. Because the subsequent development of these actions is limited by the operations already mastered by the child, and by the already existing level of development of its psychophysiological functions, a certain discrepancy arises between the two that is resolved by a 'tightening up' of the operations and functions to the level demanded by the development of new actions. Play of the preschool type, the role game, is thus originally limited almost exclusively to outward actions performed by motor operations prepared by play, i.e. by manipulation in pre-preschool childhood. But the new, preschool type of play and the content of the new actions that are developed in it demand quite different means of realising it. They are also, in fact, formed extremely quickly ('on the hop', as is often said); in particular, inner mental operations are quickly formed in the child at this time.

The course of changes within stages as a whole thus takes two counter directions, figuratively speaking. Their main, decisive direction is from initial changes in the round of the child's life relations and the round of its activity to the development of actions, operations, and functions. The other direction is that from a secondarily arising reconstruction of functions and operations to the development of a given round of the child's activity. Within a stage the course of the changes leading in this direction is limited by the demands of the circle of activity that characterises the given stage. Crossing of the boundary already signifies the transition to another, higher stage of psychic development.

Interstadial transitions are characterised by opposing features. The relations into which the child enters with the world around it are, by their nature, social relations, for it is precisely society that constitutes the actual, primary condition of its life, determining both its content and its motivation. Every one of a child's activities therefore does not simply express its relation with objective reality; existing social relations are also expressed objectively in each of its activities.

A child is finally transformed, in developing, into a member of society bearing all the obligations that society puts upon it. The successive stages of its development are also nothing else than the separate stages of this transformation.

The child does not only actually change its place in the system of social relations, however; it also becomes conscious of these relations and interprets them. The development of its consciousness finds expression in a change in the motivation of its activity; old motives lose their stimulating force and new ones are born leading to a reinterpretation of its former actions. The activity that used to play the leading role begins to be shed and pushed into the background. A new leading activity arises, and with it a new stage of development also begins. These transitions, in contrast to intrastadial changes, go further, viz., from changes in actions, operations, and functions to changes in activity as a whole.

Whatever particular process of a child's psychic life we take, analysis of the motive forces of its development thus inevitably leads us to the main forms of its activity, to the motives encouraging them, and consequently to what sense the child is discovering in the objects and phenomena of the world around it. From that aspect the content of a child's psychic development also consists precisely in the place of particular psychic processes in its activity being altered; and the features of it that these particular processes acquire at the different stages of development depend on that. In conclusion we must stress the following point: we have been able to survey psychic development in this essay only from the procedural aspect, so to speak, of the psyche, almost entirely omitting the most important question of the inner interconnections of the changes in activity with the development of the picture or image of the world in the child's consciousness, and with the change in the structure of its consciousness. Interpretation of that issue requires a preliminary exposition of the psychological problem of the unity of development of sensory contents, consciousness, and those categories of consciousness that are at variance with one another, which we render by the terms 'meaning' and 'sense'. We do not have the space here to go into this matter.

THE PRINCIPLES OF THE CHILD'S PSYCHOLOGICAL DEVELOPMENT AND THE PROBLEM OF MENTAN DEFICIENCY

Thousands and thousands of children in various countries display a delay in their intellectual development, although they are essentially the same as their coevals in all other respects. These are children who manifest an inability to study with sufficient success and at adequate tempos in conditions that are considered normal. When these children are put into conditions suitable for them, and when special methods of teaching are used with them, they succeed in making considerable progress, as experience has shown, and sometimes even completely overcome their backwardness.

These last cases deserve our special attention. Each one of them gives us to think about those who remain in the category of deficient mental development, and of those who are 'beyond the threshold'.

Were these children actually doomed? Or was their fate determined by the effect of conditions and chance factors, i.e. of conditions that could have been altered, of chance factors that could have been removed from their path of development?

Yet another question arises here. What is the value of the intervention of psychologists and doctors, of their diagnoses, forecasts, and selection methods, in the problem of mental deficiency, and what end result have they produced? Do they lead to a reduction in the number of children remaining intellectually undeveloped? Or do they sometimes yield an opposite result?

This question may seem exaggeratedly alarmist and in no way justified. There are grounds, however, for posing it. I have in mind facts which indicate that the broad use made of psychological tests in many countries to select children according to the intellectual giftedness blocks the chance of receiving a sound education not only for those who really cannot study quite successfully because of organic defects, but sometimes also for those who, although they were not able to overcome their first difficul-

ties, *can* do so. It would be incorrect, however, to reduce everything simply to the technical imperfection of methods of diagnosis and selection. The cause giving rise to the facts to which we refer lies much deeper. It consists in an unsatisfactory interpretation of the very nature of 'subnormality', which in turn depends on theoretical views of the course of the child's mental development.

It is a matter of an understanding of mental deficiency that stems from the view of children's psychic development as a process determined by the action of factors of a dual nature, viz., on the one hand, endogenous, biological factors, above all heredity, and on the other hand of exogenous, environmental factors.

This view of development is very common and appears to be a simple statement of obvious facts. Discussions are therefore usually concerned with what is the significance of endogenous factors and what of exogenous ones, what is the role of a child's biological peculiarities in mental development, and what is the role of the social milieu. Some writers ascribe decisive importance to biological factors, others to social ones, and still others take the view of a convergence or coincidence of the two. The different conceptions advanced within the context of this general idea are quite well known, and I shall not go into them here.

Although these conceptions also differ from one another theoretically, they answer the question of the basis of mental deficiency in fundamentally the same way. This happens because, when the criterion of mental deficiency mentioned above is used, namely of the lag in development displayed by a child compared with the average level achieved by children of the same age *in similar external conditions*, and when, at the same time, one starts from the 'factor' theory of development, reference to the role of environmental factors is made impossible. When, moreover, one is unable, as often happens, to find some distinct pathological peculiarities in a child with retarded intellectual development, an assumption is made about the influence of an inner factor like general giftedness. From that arises the practice of using tests measuring the so-called intelligence quotient (I. Q.).

Even at best the results of the measurements obtained by means of these tests only yield a very superficial orientation as to the level of development. They disclose noth-

ing, naturally, about the nature of mental deficiency, and can explain nothing about it. They simply create an illusion of explaining why a given child is backward in its intellectual development. They therefore cannot provide any grounds for conclusions as to what methods to use in relation to some child or another, or group of children, in order to overcome their intellectual deficiency. On the contrary, rather, by claiming to study some allegedly stably operating factor, and that their indices are of decisive prognostic significance, they foster an idea of the fatality of mental deficiency and so retard the development of active, scientifically substantiated and differentiated methods of pedagogical work with backward children.

The fact that a child's fate is sometimes decided in accordance with its I. Q. should cause especially great disquiet. And that it is done in spite of the fact that the variability of the I. Q. has been demonstrated not only in practice but also by special studies made, in particular, on twins.

It seems to us that what we have said calls for revision of many traditional views and above all for a different conception of the process of a child's mental development itself.

The point is to formulate certain principles of development which, in my view, make it possible to eliminate several of the difficulties that arise for those who devote themselves to work with mentally deficient children.

I shall limit myself to consideration of the three most important of these principles.

1. The Child's Mental Development as a Process of Assimilating Human Experience

A child's mental development differs qualitatively from the ontogenetic development of the behaviour of animals. This difference is determined primarily by the fact that the *main thing* in a child's development is the process, which does not exist in animals, of mastering or 'appropriating' the experience accumulated by mankind in the course of social history.

We distinguish experience of two kinds in animals: (a) that accumulated phylogenetically and reinforced by heredity; and (b) individual experience acquired during life. Two kinds of behaviour mechanism correspond to them. On the one hand there are hereditary mechanisms that are either already completely ready for action at the moment of birth or that gradually mature during ontogenetic development; these mechanisms are formed in accordance with the general laws of biological evolution; it is a slow process corresponding to slow changes in the environment. In animals these mechanisms are of *fundamental* adaptive importance.

On the other hand there are mechanisms of the acquiring of individual experience. Their main feature is that only the possibility of the moulding of behaviour that realises individual adaptation is fixed in them by heredity, whereas the behaviour itself is fixed in inherited mechanisms. Although the mechanisms of acquiring individual experience enable an animal to adapt itself to quickly changing environmental conditions, their own evolution, like that of the mechanisms of inherited behaviour, proceeds slowly.

In distinguishing the existence of two kinds of experience in animals and accordingly of two kinds of mechanism of behaviour, we must specially stress that they are interconnected functionally as well as genetically. It can be taken as an established fact that the manifestation of inherited behaviour is in no way independent of individual experience; on the other hand, individual behaviour always takes shape on the basis of inherited, species behaviour. The individual behaviour of animals thus always depends (a) on the special experience fixed in mechanisms of unconditioned-reflex, instinctive behaviour and (b) on the individual's experience accumulated ontogenetically by means of the mechanism of conditioned reflexes. The basic function performed in animals by the mechanisms of the forming of individual experience consists, moreover, *in the adaptation of species behaviour to variable elements of the environment*. Animals' ontogenetic development can hence be represented as the accumulation of individual experience mediating the performance of their instinctive activity progressively better in complex, dynamic, external conditions.

Matters are quite different with man. Unlike animals man has experience of yet another kind, viz., the social,

historical experience he has acquired. It does not coincide with either species experience, biologically inherited, or individual experience, with which it is often incorrectly confused.

What is this experience exclusively characteristic of man?

Mankind, governed by the action of social laws, has developed very great spiritual capacities throughout history. The thousands of years of social history have done more in this respect than the millions of years of biological evolution. These advances of psychic development have been gradually accumulated in being transmitted from generation to generation. This means that they were reinforced. But could they have been reinforced in the form of biological changes transmittable by heredity? They could not, because extremely rapid, accelerating historical progress, and consequently the equally rapid change in the demands put on man's capacities by the conditions of his life in society, were at variance with the much slower tempos of the biological fixing of experience.

The advances of human historical development were reinforced and passed on from generation to generation in a special form, namely in an exoteric, external form.

This new form of the accumulation of phylogenetic (or rather socio-historical) experience arose in man because the activity specific to him is productive activity. Such, above all, is men's main activity, their work.

An all-round scientific analysis of this activity was first made by Karl Marx. Man's activity realising the process of production (both material and spiritual) is stamped on its product; what is manifested in action, in movement, at the pole of man, is transformed into a fixed property at the pole of the product. This transformation is also a process in which human capacities, i.e. the advances of the species' socio-historical development, are 'objectivised'.

Every object made by man—from a hand tool to the modern electronic computer—embodies mankind's historical experience and at the same time also embodies the mental aptitudes moulded in this experience. This point comes out even more clearly perhaps in language, science, and works of art.

In contrast to the phylogenetic development of animals, whose advances are consolidated in the form of a change

in their biological organisation itself and in the evolution of their brain, the advances of men's historical development are consolidated in the material objects and the phenomena of ideas (language, science) that men create. The point hardly needs demonstrating.

There is another process that is more complicated and at the same time more important for us, namely the process of the mastering or appropriation by separate individuals of the advances of preceding generations' spiritual development embodied in the objective things and phenomena created by them.

From its very birth a child is surrounded by the objective world created by people, namely everyday objects, clothes, very simple instruments, and language and the notions, concepts, and ideas reflected in language. A child even encounters natural phenomena in conditions created by men; clothing protects it from exposure and artificial light dispels the gloom of night. The child, it can be said, begins its psychic development in a human world.

Does the child's development, however, proceed as a process of its adaptation to this world? It does not; in spite of the widely held opinion to the contrary, the concept of adaptation by no means expresses the essential in child's psychic development. The child does not adapt itself to the world of human objects and phenomena around it, but makes it its own, i.e. *appropriates* it.

The difference between adaptation in the sense that the term is used in regard to animals, and appropriation, is as follows: biological adaptation is *change* of the subject's species properties and capacities and of its congenital behaviour caused by the requirements of the environment. Appropriation is another matter. It is a process that has as its end result the individual's *reproduction* of historically formed human properties, capacities, and modes of behaviour. In other words it is a process through which what is achieved in animals by the action of heredity, namely the transmission of advances in the *species'* development to the *individual*, takes place in the child.

Let us take a very simple example. In the world around it the child comes up against the existence of language, which is an objective product of the activity of preceding human generations. In the course of its development the child makes this *its* language. And this means that such

specifically human capacities and functions are moulded in it as the capacity to understand speech and to talk, and the functions of hearing speech and articulation.

These capacities and functions, we know, are not inborn but arise during ontogenesis. What brings them into existence? First of all the fact of the existence of *language* itself in the child's environment. As regards its inherited, biological characteristics, they constitute only the necessary conditions for these capacities and functions to be formable.

For speech hearing to be formed in a child, for instance, it must, of course, have organs of hearing and the organs involved in articulation. But only the objective existence of spoken sounds in the child's environment can explain why it develops an ear for speech. Even the qualities this hearing will have, whether it will be one predominantly of timbre or of tone, and what phonemes it will be able to discriminate, will depend on the phonetic features of the language the child masters.

What does the process itself of separate individuals' appropriation of the experience accumulated by men during the history of human society, and embodied in the objective products of their collective activity, that is to say the process that is at the same time one of the shaping of human capacities and functions in it, consist in?

We must first stress that this is always an *active* process. To master an object or phenomenon it is necessary to do things actively that are adequate to what is embodied in the object or phenomenon. When we say, for example, that a child has mastered some tool or instrument, we mean that it has learned to use it correctly and that it has formed the necessary motor and mental actions and operations for that.

Can these actions and operations, however, be formed in a child by the influence of the object itself? Obviously they cannot. Objectively they are embodied, *given* in the object, but subjectively, for the child, they are only *posed* or *defined*.

That being so, what leads the child to develop the required actions or operations in itself, and the capacities and functions needed to perform them? It is the fact that its relations with the world around it are mediated by its relations with people and that it comes into practical and speech *contact* with people.

Let us examine how a baby masters such a simple thing as a spoon.

Let us begin with an imaginary case.

The baby has never seen a spoon, and now one is put into its hand. What will it do with it? It will manipulate it, move it, bang it, try to put it in its mouth, and so on. In other words, the spoon will appear to it from the aspect of its non-specific, 'natural', physical properties rather than from the aspect of the ways of using it developed by society, which are embodied in its shape.

Now let us take a real case. Its mother or nurse feeds the baby from a spoon; a little later she puts the spoon into its hand, and the baby tries to feed itself. As observations have established, its movements are subordinated to the natural way of 'putting what is held in the hand into the mouth'. The spoon in its hand is not kept in the required horizontal position and so food is spilt onto its bib. But its mother does not, of course, remain uninvolved. She helps the baby and intervenes in its action; in the *joint* action thus arising the baby gets the knack of using a spoon. It has now mastered the spoon as a *human* object.

I have used example in order to pose yet another question. Can we assume that a baby could acquire the knack of using a spoon without contact, without joint action with adults, i.e. in the way that habits are formed in animals? Theoretically, of course, we can. It is even possible, in practice, to put a child in such conditions that this way would prove to be the only one possible. But that is a completely abstract assumption, a Robinson Crusoesque situation. A child cannot in fact live and develop without practical and speech contact with adults.

Let us assume, all the same, that a baby is forced to develop some ability or other, some habit or other, independently, even if only because the methods being used by the adults helping it and bringing it up are not sufficiently suitable. It may be successful, but how much time it will take, and how far behind its more fortunate coeval 'whose hand was rationally controlled' it will lag in this habit!

So as not to complicate our exposition, I have taken an example of the forming of motor operations, but what has been said becomes much more evident from an analysis of the mastering of *mental* actions like reading, writing,

and counting. It is particularly clear, in these cases, that their forming is a business of mastering operations built up in the experience of preceding generations, and that they cannot arise in other learning conditions than those that direct the child's activity, and *build* its actions. We shall return to the process of the forming of these operations again, however.

It remains to deal with yet another, last matter, the question of the role of individual experience in the proper sense in a child's development. I have tried to show that a child's appropriating of the experience of preceding generations is a specific process that differs from the forming of individual experience and from adaptation in animals both in the conditions in which it takes place and in its mechanisms. At the same time the mechanisms of the adaptation of individual experience are also involved in a child's development, but they fulfil the role, as we shall see, only of partial mechanisms realising appropriation or assimilation. That is one aspect of the matter; another is that they already fulfil the function I have indicated, namely of realising adaptation of phylogenetic experience to changing external conditions. Only in man, however, does this also apply to the historical experience that he assimilates during his life.

What we have said can thus be summed up in the following propositions.

The main process characterising a child's psychic development is the specific one of mastering or assimilating the advances of preceding generations, which differ from advances in animals' phylogenetic development in not being fixed morphologically, and in not being transmitted by inheritance.

This process is realised in the child's activity in relation to the objects and phenomena of the world around it in which these advances of humanity are embodied. This activity cannot, however, be formed of itself in the child; it is formed in practical, speech contact with the people around it and in joint activity with them; when the goal of this activity consists specially in transmitting definite knowledge, abilities, and skills to the child, we say that the child learns and the adult teaches.

It sometimes seems that the child only puts capacities and psychic functions inherent in it from nature into opera-

tion and that progress depends on them, but that is not so. Its *human* capacities are formed in the process itself, and that is the essence of the second principle that characterises a child's mental development. We shall now proceed to the exposition of that.

2. The Development of Capacity as the Forming of Functional Brain Systems

The point that the psychic capacities and functions formed during socio-historical development are reproduced by the individual through intravital acquisition rather than through the effect of biological inheritance faces us with the very complicated question of their anatomical and physiological basis.

From a scientific, materialist standpoint, it is impossible, of course, to assume the existence of capacities or functions that do not have their specialised organs. Attempts have therefore been made for a long time to localise various higher psychic processes in definite, morphologically consolidated structures of the brain. The existence of any one capacity or function in man has been related to the presence of innate brain structures corresponding to them, as the special organs of these functions. This was also extended to capacities that could only arise in man during the development of society. In other words, their direct hereditary conditioning was assumed.

While it is necessary to accept the first proposition, i.e. that *any* capacity or function is a function of a definite organ, it is impossible to accept the second one, just mentioned, without reservations. It contradicts a host of well-established facts.

How then are we to reconcile the view of man's higher psychic functions as having their morphological, physiological basis, with the assertion that these functions are not morphologically fixed and are transmitted solely by way of their *social* 'inheritance'?

An answer to this problem has been prepared by the progress made by the physiology of higher nervous activity. I have in mind, above all, the classic work of Sechenov and of Pavlov and his successors, in particular Anokhin, and

also the work of Ukhtomsky. That is one side of the matter.

On the other hand, an answer has been prepared by the mass of psychological research into the forming and structure of man's complex psychic functions, among which I would refer to the work of Vygotsky (1896-1934) and his associates.

The answer suggested is that, simultaneously with the forming of higher, specifically human psychic processes in a child, the brain's functional organs that realise them are formed at the same time, viz., stable, reflex associations or systems that serve to perform certain acts.

We already find the possibility of the intravital forming of such functional brain systems in higher animals, but only in man do they become ones realising real *new formations* in his psychic development, and does their formation become a most important principle of the ontogenetic process.

The findings of the research at our disposal make it possible to describe these functional organs arising intravitally in more detail.

The first of their features is that, once formed, they then function as a single organ. The psychic processes realised by them can therefore acquire the character, as it were, of direct acts expressing a special capacity, like a capacity to judge spatial, quantitative, or logical relations directly.

Another feature is their relative strength, which is expressed in the functional systems concerned not fading, as conditioned reflexes do, although they are formed through the formation of conditioned-reflex connections. A capacity to visualise tactilely perceived shapes, for example, is formed intravitally, and therefore is completely absent in children who are blind from birth; but among those who have lost their sight after this capacity has been formed in them, it is preserved for decades, although any reinforcement of the tactile-optic links in them is naturally impossible.

A third feature is that these organs are restructurable and that their separate components can be replaced by others, with the functional system concerned preserved as a whole. In other words they display a very high capacity for compensation.

To show how these functional organs are reconstructed we must first consider how they are formed.

They are formed by the general mechanism of the formation of conditioned links, but in a different way to how ordinary chains of conditioned reflexes or stereotypes are formed.

The links forming them do not simply reproduce the order of the external stimuli but unite relatively independent reflex acts and their developed motor efferent and feedback afferent innervation into a single system. They are integrated, moreover, through the uniting of their motor effectors.

During the formation of such a new 'composite' action, the motor effectors of these acts are linked together. This action, which is a functional motor system, initially always has a maximally developed external form. Subsequently the separate external motor components of the action formed are gradually reduced, and their links function only as intracerebral, intracentral ones. The action as a whole is reduced and condensed, and begins to operate automatically.

In becoming part of a new action, the previously independent separate reflex acts understandably lose their adaptive significance as a consequence of the reduction of their external motor links. Reinforcement or non-reinforcement can now, therefore, apply only to the final effect of the action as a whole. That also creates the distinctive dynamics of these functional systems. As the experimental findings indicate, it is typical of their dynamics that reinforcement of a system's final link leads to inhibition of more and more of its links, and to its further condensation; absence of reinforcement, on the contrary, disinhibits them. That is explicable, it may be supposed, by inhibition of the last, final link of the system causing excitation, by the law of induction of the links that had been inhibited.

Externally this peculiar dynamics is manifested in these actions, being functional systems, having a tendency to develop if they come up against a difficulty. When they lead to the required end effect they are reduced more and more until they cease to yield that effect; then the links that were inhibited last are disinhibited and the system again becomes effective.

In our laboratory at Moscow University we were able to

trace the formation of certain sensory functional systems in detail experimentally, especially the system of tonal (pitch) hearing. We succeeded in restructuring subjects' hearing actively in those experiments, exteriorising and tuning their main motor component (attuning vocalisation of the perceived sound to its fundamental pitch). In our latest experiments we tried to replace this component by another one, namely adequate toning of the muscles of the hand, which was specially developed for the purpose. The initial findings of these experiments confirm that such a substitution is possible.

This research, and that of other workers on normal subjects, and the work of Luriya and his associates on mentally backward children, permit us to suggest the following, which summarises what we have said.

A child is not born with organs ready to perform those functions that are the product of man's historical development and that are developed in the child during its life through its assimilation of historical experience.

The organs of these functions are functional brain systems ('the brain's mobile physiological organs', as Ukhtomsky puts it), which are formed by the specific process of appropriation or assimilation described above.

Research findings indicate that these systems are not formed in all children in the same way; and depending on how the process of development takes shape in them, and on what conditions it proceeds, they may prove in some cases not to be adequately formed at all (we have met such a case, for example, in the phenomenon of 'tone deafness' to a difference in the fundamental pitch of sounds).

In these cases it is possible to restructure the functional systems, or functional organs, underlying these processes, or to form them anew, in an active way on the basis of painstaking analysis of the structure of the corresponding processes.

What we have said applies to systems regulated by speech (Luriya), and to speech itself, as well as to purely motor and sensory systems.

The moulding of inner thought operations in a child is a more complicated bussiness, which therefore deserves special consideration.

3. The Child's Intellectual Development as the Forming of Mental Actions

We have already seen that a child's psychic development takes place through intercourse, initially practical contact, but it already very early also enters into speech contact with those around it. It encounters words, and begins to understand their meaning and to use them actively in its speech. The mastery of speech is a most important condition for its mental development because the content of people's historical experience, and the experience of their socio-historical practice, are not only reinforced, of course, in the form of material things but are generalised and reflected in verbal, spoken form. It is in this form that the wealth of the accumulated knowledge and concepts of the world around the child appear to it.

The child is faced with the task of mastering this knowledge and these concepts. To do so, however, it must master those cognitive processes that are adequate to (but not, of course identical with) the processes whose product the given concepts are.

How are these cognitive, intellectual processes fostered in the child?

Two possible assumptions must be discarded here, at the start, as invalid.

(1) One is the assumption, quite groundless, that a child possesses innate intellectual functions and cognitive operations, and that the external phenomena acting on it simply bring them into operation.

(2) The other assumption is that thought operations are formed in the child through the influence of its personal, individual experience, that the child is subjected to influences in the course of training whose repetition and reinforcement have the result of developing only new conditioned links or associations in it, and that its thought activity is nothing else than a simple reproduction of these links or associations.

This last idea is in contradiction with the facts, for such a way of forming thought processes would call for reliance on vast experience and require a very long time. In fact, however, the forming of thought processes in a child is based on relatively short individual experience and takes place

relatively very quickly, which is due to the child's assimilating of experience in an already generalised form. No generalisation can, however, be transmitted to it ready-made, so to speak. An association like 'three plus four is seven' or 'five minus two is three' can, of course, be formed in a child, but it does not lead to its mastering the corresponding arithmetical operations and the concept of number. The teaching of arithmetic therefore does not begin with that but with the active formation of operations with external objects, i. e. with appropriate transpositions and counting of them. Then these external operations are gradually converted into verbal ones ('counting out loud'), are condensed, and finally acquire the character of internal operations ('counting in one's head') which proceed automatically in the form of simple, associative acts. At the bottom of them, however, there are now those developmed actions with quantities that we had built up beforehand in the child. Therefore they can always be developed and exteriorised again by it.

The mastering of concepts, generalisations, and knowledge therefore require adequate mental operations to be formed in the child. And for that they must first be actively built up in it. They arise first in the form of external actions that the adult moulds in the child, and only then are they converted into internal, intellectual operations.

This process has been studied in quite some detail by Halperin and his associates. It begins with the child's preliminary orientation in the problem, i. e. in its being shown the action and its product. That also constitutes the 'ranging basis' of the first actions that the child learns to perform. These, as we have already said, are carried out in the form of external operations with external things and an adult's direct help. And their transformation has already begun at that stage; the child learns to perform them by itself, they take on a more generalised character, and are reduced.

Later, in the next stage, the actions pass to the spoken plane and are verbalised. The child learns to count out loud without reliance on external objects. At that stage the action takes on the character of a *theoretical* one; it now takes place as an action with words and verbal concepts. At this stage there is a further conversion of the action in the directions mentioned above, and it gradually becomes automatic. Only in the next stage is it wholly transferred to the

mental plane and does it there undergo further changes until it finally acquires all the features inherent in internal thought processes. At that stage it can, of course, be corrected and controlled by an adult, who has to exteriorise it again, to bring it back, for example, to the plane of audible speech.

I have described the forming of mental operations only in a general way. Lacking the space to go into detail here, I shall limit myself simply to a few remarks.

(1) The process does not always by any means occur in all three of the stages mentioned, and may begin directly with formation on the plane of speech, depending on the preceding advances in the child's mental development.

(2) The course of the process as a whole forms various types. From the standpoint of the problem of the mentally retarded child I would like simply to note the following in this connection. If the persons training a child primarily set themselves the goal of imparting knowledge of some sort or other and pay little attention to how the child itself goes about it, by what operations it solves the school problems it has been set, and does not check whether a further transformation is taking place at the proper time in these operations, their development can be disturbed.

To explain what I mean, let me cite a simple experiment I once made in a school for mentally backward children.

I drew attention to the fact that the pupils, while doing mental addition, were using their fingers for it in a concealed way. Then I asked for several saucers, gave two to each pupil, and told them to hold them above the desk while they were giving their answers. In these conditions it proved that the operation of adding numbers broke down completely in most of them. More detailed analysis indicated that these children had in fact remained at the stage, as regards addition, of the external operations of 'counting by ones', and had not passed to the next stage. They therefore could not advance in learning arithmetic beyond actions within the first ten numbers without special help. For that purpose it was necessary, not to take them further, but on the contrary to return them first to the original stage of developed external operations, to 'reduce' these operations properly and to transfer them to the oral plane, in short to build a capacity 'to count in their head' all over again

Research has shown that such a reorganisation is actually possible even when working with children of quite pronounced

mental backwardness. It is specially important that this approach has the effect, in cases of a slight lag in mental development, of completely eliminating it.

Such intervention in the forming of mental operations of some kind or other must, of course, be prompt and timely, because otherwise the forming of the process cannot proceed further normally because the stage of its forming has sometimes not been built up by chance or has been built up incorrectly, with the result that an impression of alleged mental incapacity in the child is created.

The problem of the methods for studying a child's intellectual development must also be tackled in accordance with everything we have said above. Intelligence tests that only ascertain what problems a child solves and what ones it does not solve, but do not bring out the features of the psychic processes themselves, should be recognised as definitely unsuited for appraising the child's mental potentialities, especially when we are dealing with cases of a slight degree of backwardness.

It remains for me to say a few words in conclusion. The principles of the child's psychological development to which I have deemed it necessary to draw attention do not, of course, exhaust all the complexities of this matter. Furthermore, I had to ignore many important questions that have been raised by the problem of mental deficiency. To avoid possible misunderstanding in this connection, I must mention the most important ones. First of all, there is the matter of the influence of the social conditions in which a child develops, and on which it depends to what extent the child can obtain active pedagogical guidance and, when it is needed, special pedagogical help. Then there is the question of the role of inherited biological properties and individual characteristics, in particular the features of the child's higher nervous activity, which it is impossible, of course, not to take into account. Finally, there are the important matters pertaining to the features of the emotional and motivational sphere of the child's personality.

In leaving all these problems aside I have tried to stress the main point, viz., the existence of the broad, unfortunately far from always utilised, possibilities of a correctional, pedagogical kind, provided by research into the process of mental development, and the inadmissibility of hasty, in essence unsubstantiated diagnoses and prognoses.

I may be reproached for excessive psychological and pedagogical optimism. I am not, however, afraid of such a reproach because my optimism is based on objective, scientific findings and is completely confirmed by progressive pedagogical practice.

NOTES

The selected papers of A. N. Leontyev published in this edition express the main line of his theoretical and experimental research. After his first work, devoted to an experimental study of affective responses [An Investigation into the Objective Symptoms of Affective Responses (jointly with A. R. Luriya) in *Sovremennye problemy psikhologii* (Moscow, 1926); Experience of the Structural Analysis of Associative Chain Series, *Russko-Nemetsky meditsinsky zhurnal*, 1928, 1 and 2; *Ekzamen i psikhika* (Examination and the Mind) (jointly with A. R. Luriya), Moscow, 1929], he began to work under L. S. Vygotsky within the context of the latter's conception of research into the ontogenetic development of the psyche [Mediated Remembering in Children with a Deficient or Morbidly Altered Intellect, *Voprosy defektologii*, 1928, 4; Development of the Internal Structure of Higher Behaviour in *Psikhonevrologicheskaya nauka* (Leningrad, 1930); *Razvitie proizvol'nogo vnimania u detei* (The Development of Voluntary Attention in Children), Moscow, 1930]. In this period he also published his first major monograph *Razvitie pamyati* (The Development of Memory), Moscow, 1931.

From 1932 Prof. Leontyev's work took a new path. Heading a group of young psychologists in Kharkov (V. I. Asnin, L. I. Bozhovich, P. J. Halperin, A. V. Zaporozhets, P. I. Zinchenko, O. M. Kontsevaya, G.D. Lukov, V. V. Mistyuk, K. E. Khomenko, and others), he directed research into the development of the child's practical intellectual activity and consciousness. On this basis he and his associates worked on the problem of relating the structure of activity to forms of psychic reflection. Several of the theoretical problems that arose in this connection, prompted Prof. Leontyev to start research in the field of various psychophysiological and zoopsychic problems. At the same time, at the suggestion of the Kharkov Polygraphic Institute, he organised and directed a cycle of work of a primarily practical nature on children's perception of illustrations. A number of papers were prepared under his direction in this period and published in *Nauchnye zapiski Khar'kovskogo pedagogicheskogo instituta* (Vol. I,X, 1939; Vol. II, X, 1941), *Nauchnye zapiski Khar'kovskogo instituta inostrannykh yazykov* (Vol. II, X, 1939), *Trudy konferentsii po psikhologii*, Vol. 1 (Kiev, 1941), and in a number of later works, some of which appear in the present volume.

After resuming work in Moscow in 1935, Prof. Leontyev devoted his main attention to the problem of the origin of sensitivity and the general theory of the evolution of the psyche, completing his experimental genetic research into the origin of sensation in 1940.

During World War II Leontyev devoted his efforts to the urgent problem of restoring motor functions damaged by gunshot wounds. For that purpose he organised a rehabilitation hospital, of which he became scientific head. (The results of this work were published in A. N. Leontyev and A. V. Zaporozhets. *Vosstanovlenie dvizheniya* (The Restoration of Movement), Moscow, 1945, and in a number of special papers by Leontyev and his colleagues in *Uchonye zapiski MGU*, 1947, 3.

Apart from its practical value this experimental research into the restoration of motor processes also played an important role in elaboration of the theory of functional development, enabling the author

later to advance a hypothesis of the systemic structure of psychic functions (1954).

In the postwar years the author again returned to the problem of child and educational psychology. At the same time he worked on several questions of general psychology. The joint session of the USSR Academy of Sciences and RSFSR Academy of Pedagogical Sciences held in 1951 on Pavlov's physiological teaching, turned his attention to study of the psyche's reflex mechanisms, which found reflection in his work in the following period [On the Materialist and Subjective Idealist Reflex Conceptions of the Psyche, *Sovetskaya pedagogika*, 1951, 10; The Dependence of Associative Connections on the Content of Action (jointly with T. V. Rozanova), *Sovetskaya pedagogika*, 1951, 10; On the Systemic Nature of Mental Functions. In: *Tezisy dokladov na yubileinoi sessii Moskovskogo Universiteta* (Moscow, 1955); On an Effect of the Forming of a Motor Chain Habit (jointly with M. I. Bobneva). *Doklady APN RSFSR*, 1958, 1; and the work cited below on analysis of the systemic structure of aural perception.] His work on educational psychology, and problems of general psychology are not included in the present volume.

The Problem of the Origin of Sensation

This paper was a section of the author's doctoral dissertation (*Razvitie psikhiki*, 1940). The first part set out his hypothesis of the origin in principle of sensitivity as a capacity for elementary sensation, which he had developed in 1933-36. The hypothesis was originally formulated in several papers in Kharkov and Moscow, and was later presented in a special paper (A Contribution to the Problem of the Origin of Sensitivity) in the symposium dedicated to the 35 years of D. N. Uznadze's scientific work (Tbilisi, 1944), and also in the first edition of the present work (*Ocherk razvitiya psikhiki*); in the present edition this chapter has been omitted. The second part of the section was an exposition of his experimental investigation of the forming of sensitivity to inadequate stimulation, which he had carried out with his colleagues in 1936-39 in the laboratory he headed in the Institute of Psychology in Moscow, and in the chair of psychology of the Kharkov Pedagogical Institute.

The Biological and Social in Man's Psyche

This was a plenary paper (evening lecture) read at the XVI International Congress of Psychology in Bonn in 1961, and published in *Voprosy psikhologii*, 1960, 6. It is reprinted here with additions.

An Outline of the Evolution of the Psyche

This paper was first published as a separate publication in 1947. In the present edition it is printed in a much abridged new version. The first two chapters have been omitted and the numbering of the chapters altered accordingly. The other chapters are partially abridged.

The chapter 'The Development of the Psyche of Animals' is a synopsis of the second part of the doctoral dissertation (*Razvitie psikhiki*, 1940). The periodisation of the evolution of forms of reflection given in this chapter also underlies Leontyev's chapter on the development of the psyche in the textbook *Psikhologiya* (Moscow, 1948).

The matter in the last chapters of this work, viz., 'The Origin of Man's Consciousness' and 'A Contribution to the Problem of the Historical Development of Consciousness', was intended by the author for a special monograph, but the material and bibliography he prepared for it were lost during the war, and in the *Outline* only the general propositions developed during his work on this monograph were reproduced in schematic form. Some of them, for example that on the structure of activity, on the meaning and personal sense of reflected reality, on the role of motives in the subject's activity, were treated in another context in the following papers: On Certain Psychological Questions of the Consciousness of Study (*Sovetskaya pedagogika*, 1944, 2); The Psychology of the Consciousness of Study (*Izvestiya APN RSFSR*, 1947, 7); Problems of Child and Educational Psychology (*Sovetskaya pedagogika*, 1948), 2) and in the papers on the development of the child's psyche published in this volume. The problem of the relation of meaning as an objective linguistic phenomenon and as a psychological phenomenon was reviewed in a special paper (A. N. Leontyev and A. A. Leontyev. On the Dual Aspect of Linguistic Phenomena. *Nauchnye doklady vysshei shkoly. Filosofskie nauki*, 1959, 2).

In 1948 the *Outline* (in its first edition) became the subject of a broad discussion. A number of the comments made during this discussion were taken into account by the author when preparing the present edition.

A Propos of the Historical Approach to Study of the Human Psyche

This paper was published in the symposium *Psikhologicheskaya nauka v SSSR* (Psychological Science in the USSR), Vol. 1 (Uchpedgiz, Moscow, 1959). It surveyed a problem first posed in the *Outline*, but from a general psychological angle and from new points of view, in particular in connection with the hypothesis of the systemic structure of man's psychic functions (capacities). This hypothesis was put forward by the author in a paper to the XIV International Congress of Psychology in Canada (1954), which was published in *Voprosy psikhologii*, 1955, 1; and in several other publications [*Proceedings of the XIV International Congress of Psychology*, Montreal, June 1954 (North Holland Publ. Co., Amsterdam, 1955); *Questions scientifique* (Paris, 1955); *Psychology in the Soviet Union* (London, 1968,) etc.].

The difference in principle between man's individual experience, species' experience, and assimilated socio-historical experience was also formulated by the author in a paper to the XV International Congress of Psychology in Strassbourg [Education as a Problem of Psychology. *Voprosy psikhologii*, 1957, 1; Le conditionnement et l'apprentissage. *Symposium de l'Association psychologique scientifique de langue française*, Strassbourg, 1956 (PUF, Paris, 1958), pp 169-216] and at the IX Congress of Philosophy in Aix-en-Province (L'Individu et les oeuvres humains. *Les études philosophiques*, 1957, 3: 186-188).

The Development of Higher Forms of Memory

This is a chapter from the author's *Razvitie pamyati* published in 1931, which presents the results of his experimental work carried out in 1928-30 in the psychology laboratory of the Krupskaya Academy of Communist Education. This research lay wholly within the stream

of the ideas of the 'cultural-historical theory' of the psyche developed in those years by Vygotsky and his associates. It was the first major piece of research devoted to the problem of the mediating of human psychic functions during ontogenetic development; a proposition about 'circulating' external aids and methods of remembering was developed experimentally in this work ('parallelogram of development').

This paper, written almost 50 years ago, naturally bears the imprint of a stage that has passed, and contains several naive, erroneous points, primarily those relating to the seeming contrast between the two spheres of psychic processes, viz., the 'natural' and the 'cultural' (mediated). In later work carried out under Prof. Leontyev's direction (P. I. Zinchenko. A Study of Involuntary Remembering. On Forgetting and the Recall of School Knowledge. *Nauchnye zapiski Kharkovskogo pedagogicheskogo instituta*, 1939, Vol. 1, X; Z. M. Istomina. The Development of Volitional Memory in Children of Preschool Age. In: *Voprosy psikhologii rebenka doshkol'nogo vozrasta* (Moscow, 1948)], this counterposing was dropped.

The Psychological Principles of Preschool Play

The basis of this paper, published in *Sovetskaya pedagogika*, 1944, 4, was unpublished propositions about play first advanced by Vygotsky. They are developed here, however, in the light of the new notions on ontogenetic development worked out by the author and his associates in 1932-40 in the psychology sector of the Ukrainian Psychoneurological Academy and the chair of psychology of the Kharkov Pedagogical Institute, and from 1936 in the Institute of Psychology in Moscow. These views start from the idea of the development of the child's activity as a condition for the forming of its consciousness that had originally been developed in research into children's practical intellectual activity (see: A. V. Zaporozhets. The Role of Elements of Practical Activity and Speech in the Development of a Child's Thinking; V. I. Asnin. The Peculiarity of Motor Skills Depending on the Conditions of Their Formation; G. D. Lukov. On the Child's Awareness of Speech in Play. In: *Nauchnye zapiski Khar'kovskogo pedagogicheskogo instituta*, 1939, Vol. X; A. V. Zaporozhets and G. D. Lukov. On the Development of Thinking in Infants. *Nauchnye zapiski Khar'kovskogo pedagogicheskogo instituta*, 1941, Vol. IV, etc.).

A Contribution to the Theory of the Development of the Child's Psyche

This paper follows the text of an article published in *Sovetskaya pedagogika*, 1945, 4. The main points developed in it were first formulated by the author in a paper The Child's Psychic Development and Education. (*Nauchnaya sessiya Khar'kovskogo pedagogicheskogo instituta. Tezisy dokladov*, Kharkov, 1938 and in discussion article Pedagogy and Psychology (*Uchitel'skaya gazeta*, 1941, No. 42); they also found reflection in several of the author's subsequent works.

The Principles of the Child's Psychological Development and the Problem of Mental Deficiency

This is the text of a lecture read at the international seminar in Milan in 1959, organised by the World Health Organisation.

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REQUEST TO READERS

A. N. Leontyev (1903—1979) was a prominent Soviet psychologist, disciple of L. S. Vygotsky, member of the USSR Academy of Pedagogical Sciences. He was a Doctor of *Honoris causa* of the University of Paris (1968), and an honorary member of the Hungarian Academy of Sciences (1973). This book contains works he wrote at different periods of his fruitful life. They treat complex and topical problems of the origin of the psyche and its historical development. Importance attaches to his articles dealing with the interconnection of the human psyche and culture, and the evolution of the higher psychic functions during the individual's assimilation of historical experience. Several articles show the development of the child's psyche.

The Author criticises behaviourist and biological conceptions of the psyche.